



DEPARTMENT OF TRANSPORTATION

Federal Railroad Administration

49 CFR Part 224

[Docket No. FRA-2021-0080, Notice No. 1]

RIN 2130-AC77

Reflectorization of Rail Freight Rolling Stock; Codifying Existing Waivers

**AGENCY:** Federal Railroad Administration (FRA), Department of Transportation (DOT).

**ACTION:** Notice of proposed rulemaking (NPRM).

**SUMMARY:** FRA proposes to amend its standards for Reflectorization of Rail Freight Rolling Stock (Reflectorization Standards) to codify waivers and remove the outdated implementation schedule. The proposed changes are expected to enhance safety, promote innovation, clarify existing requirements, and reduce unnecessary paperwork burdens. The proposed amendments are consistent with the mandate of the Infrastructure Investment and Jobs Act (IIJA), which requires FRA to review and analyze certain longstanding waivers to determine whether incorporating the waivers into FRA's regulations is justified.

**DATES:** Comments on the proposed rule must be received by [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

Comments received after that date will be considered to the extent practicable.

**ADDRESSES:** *Comments:* Comments related to Docket No. FRA-2021-0080 may be submitted by going to <https://www.regulations.gov> and following the online instructions for submitting comments.

*Instructions:* All submissions must include the agency name and docket number or Regulatory Identification Number (RIN) for this rulemaking. Note that all comments received will be posted without change to <https://www.regulation.gov>; this includes any personal information. Please see the Privacy Act heading in the **SUPPLEMENTARY INFORMATION** section of this document for Privacy Act information related to any submitted comments or materials.

*Docket:* For access to the docket to read background documents or comments received, go to <https://www.regulations.gov> and follow the online instructions for accessing the docket.

**FOR FURTHER INFORMATION CONTACT:** Check Kam, Mechanical Engineer, Office of Railroad Safety, at telephone: (202) 366-2139 or email: [check.kam@dot.gov](mailto:check.kam@dot.gov); or Michael Masci, Senior Attorney, Office of the Chief Counsel, at telephone: (202) 493-6037 or email: [michael.masci@dot.gov](mailto:michael.masci@dot.gov).

**SUPPLEMENTARY INFORMATION:**

**Abbreviations and Terms Used in This Document**

AAR – Association of American Railroads

ASLRRA – American Short Line and Regional Railroad Association

ASTM – ASTM International (formerly known as American Society for Testing and Materials)

CE – Categorical Exclusion

CFR – Code of Federal Regulations

DOT – Department of Transportation

EA – Environmental Assessment

EIS – Environmental Impact Statement

FHWA – Federal Highway Administration

FR – Federal Register

FRA – Federal Railroad Administration

GS – General Schedule

IIJA – Infrastructure Investment and Jobs Act (Pub. L. 117-58)

IRFA – Initial Regulatory Flexibility Analysis

LED – Light-Emitting Diode

MOW – Maintenance of Way

NEPA – National Environmental Policy Act

NPRM – Notice of Proposed Rulemaking

OMB – Office of Management and Budget

PRA – The Paperwork Reduction Act

RIT – Run-Into-Train

RRA – Running Repair Agent

S-916 – AAR’s Standard S-916; Retroreflective Comparator Panel Requirements

SCABT – Single Car Air Brake Test

SIA – Specific Intensity per unit Area

STB – Surface Transportation Board

THEERP – Tourist, Historic, Excursion, Educational, Recreational, or Private

TTI – Texas A&M Transportation Institute

UMLER – Universal Machine Language Equipment Register

U.S.C. – United States Code

Volpe – Volpe National Transportation Systems Center

## **Table of Contents for Supplementary Information**

### **I. Executive Summary**

### **II. Statutory and Regulatory Background**

#### **A. Existing Reflectorization Requirements**

- B. Waivers Excluding from Part 224 Rail Freight Rolling Stock Used Only for Tourist, Historic, Excursion, Educational, Recreational, or Private (THEERP) Purposes, Except for Incidental Freight Service
- C. Waivers Allowing Development and Testing of Alternative Methods to Determine When to Replace Retroreflective Sheeting

### III. Overview and Technical Discussion of Proposed Requirements

- A. Proposal to Exclude from Part 224 Rail Freight Rolling Stock Used Only for THEERP Purposes, Except for Incidental Freight Service
- B. Proposal to Allow Alternative Methods to Determine When to Replace Retroreflective Sheeting
  - 1. The Existing 10-year Replacement Cycle Ensures Effective Retroreflective Sheeting, but May Require Replacement Sooner than Necessary
  - 2. FRA Worked Closely with The Association of American Railroads (AAR) and Texas A&M Transportation Institute (TTI) to Develop a Comparator Panel that Could be Used with the Reflectorization Standards
  - 3. FRA Approved a Pilot Program to Test AAR's Standard S-916; Retroreflective Comparator Panel Requirements (S-916) in Service

### IV. Section-by-Section Analysis

### V. Regulatory Impact and Notices

- A. Executive Order 12866
- B. Regulatory Flexibility Act and Executive Order 13272
- C. Paperwork Reduction Act
- D. Federalism Implications
- E. International Trade Impact Assessment
- F. Environmental Impact
- G. Executive Order 12898 (Environmental Justice)
- H. Unfunded Mandates Reform Act of 1995
- I. Energy Impact

## J. Privacy Act Statement

### **I. Executive Summary**

#### *Purpose of the Regulatory Action*

FRA periodically reviews, and proposes amendments to, its regulations to identify ways to enhance safety, and update regulatory requirements. This proposed rule is expected to enhance safety, promote innovation, reduce unnecessary costs, and clarify existing requirements. Moreover, FRA expects reduced environmental waste resulting from not needlessly replacing retroreflective sheeting prior to the end of its useful life.

This proposed rule would respond to the mandate of section 22411 of the IIA (Pub. L. 117-58) which requires the Secretary to review and analyze existing waivers issued under 49 U.S.C. 20103 that have been in continuous effect for a 6-year period to determine whether issuing a rule consistent with the waiver is in the public interest and consistent with railroad safety. After conducting the appropriate analysis, if the Secretary concludes that it would be in the public interest and consistent with railroad safety to initiate a rulemaking to incorporate into the regulations the relevant aspects of the waivers analyzed, section 22411 specifically authorizes the Secretary to initiate such a rulemaking.

#### *Summary of the Regulatory Action*

The Reflectorization of Rail Freight Rolling Stock (Reflectorization Standards or Part 224) contain minimum safety requirements to help motor vehicle operators contain minimum safety requirements to help motor vehicle operators see rail freight rolling stock at night and under conditions of poor visibility. Part 224 was designed to reduce the number and severity of highway-rail grade crossing accidents and deaths, injuries, and property damage resulting from those accidents. Generally, FRA has provided two types of relief from part 224's requirements: (1) relief to THEERP operations, because

they do not typically travel over low visibility highway-rail grade crossings at nighttime; and (2) relief to allow the use of a performance-based method (comparator panels) to determine when to replace reflectorization sheeting. FRA proposes to codify these waivers for two reasons: (1) freight rolling stock used exclusively for THEERP purposes do not typically travel over low visibility highway-rail grade crossings at nighttime; and (2) to allow the replacement of retroreflective sheeting to be based on alternative methods of evaluating its effectiveness. Allowing for performance-based methods of reflectorization evaluation and replacement is a more reliable and accurate way to evaluate the effectiveness of the retroreflectivity of the required sheeting than part 224's current 10-year default replacement cycle. Codifying these waivers is expected to enhance safety (i.e., by ensuring retroreflective sheeting is replaced when it is no longer effective), promote innovation, and reduce unnecessary paperwork burdens for both industry and FRA by eliminating the need to continue to use the waiver process for relief. Codifying these waivers would also provide the railroad industry with regulatory certainty as to the applicability of part 224 to equipment used for THEERP purposes, while enhancing safety.

Finally, FRA proposes to remove § 224.107, which has become outdated. Section 224.107 requires the locomotive fleet population to be fully equipped with part 224 compliant retroreflective sheeting by November 28, 2010, and the freight car fleet to be compliant by November 28, 2015. FRA is proposing to remove this section, because the implementation dates have passed and are no longer necessary to have in the regulation.

#### *Costs and Benefits of the Proposed Regulatory Action*

The proposed rule would eliminate the need for railroads to submit waiver petitions (and repeated extensions of those waivers every 5 years) from part 224 for certain older railroad equipment used in THEERP operations, and eliminate the Federal Government's need to review and approve the waiver petitions and extension requests.

In addition, the proposed rule would allow railroads and private car owners to replace retroreflective sheeting based on performance, instead of time, thus increasing efficient use of resources and reducing environmental waste from discarding retroreflective sheeting prior to the end of its useful life. FRA estimates there will be minor costs for purchasing and recalibration of the comparator panels used to evaluate retroreflective sheeting, and training employees in their use (about 0.2% of total NPRM costs).

FRA expects the proposed rule to enhance safety, promote innovation, clarify existing requirements, and reduce unnecessary burdens. Entities that have been operating under the THEERP waivers and performance-based waivers using a comparator panel to evaluate retroreflective sheeting have not shown an increase in accidents/incidents. Also, retroreflective sheeting that is performing poorly would likely be replaced sooner under the NPRM than under the existing 10-year replacement cycle, better ensuring continued effectiveness of the sheeting. Overall FRA estimates the proposed rule will result in net benefits in terms of businesses benefits. FRA's estimates of benefits for the NPRM are shown in the table below.

**Table ES-1: Summary of Total Benefits over the 20-Year Period (2020 Dollars)**

<b>Impact</b>	<b>Undiscounted</b>	<b>Present Value 7%</b>	<b>Present Value 3%</b>	<b>Annualized 7%</b>	<b>Annualized 3%</b>
<b>Baseline Cost</b>	\$540,747,953	\$286,435,001	\$402,248,463	\$27,037,438	\$27,037,415
<i>Baseline Costs consist of Visual Inspection &amp; Replacement, 10-Year Renewal, Transportation of Cars Typically not Interchanged, and Waivers.</i>					
<b>NPRM Cost</b>	\$436,091,940	\$231,038,590	\$324,420,840	\$21,808,408	\$21,806,176
<i>NPRM Costs for Visual Inspection &amp; Replacement; Periodic Evaluation &amp; Retroreflective Sheeting Replacement (Performance-Based); Transportation of Cars Typically not Interchanged; 10-Year Renewal (@15% of Cars, Provides Flexibility for Small Entities); and Comparator Panel Purchase, Recalibration, and Employee Training.</i>					
<b>Net Benefits</b>	<b>\$104,656,013</b>	<b>\$55,396,411</b>	<b>\$77,827,623</b>	<b>\$5,229,029</b>	<b>\$5,231,239</b>
Government Costs for Waivers (Baseline)	\$167,171	\$89,183	\$124,739	\$8,418	\$8,384
Qualitative Benefit: Reduced environmental waste from not replacing effective reflective sheeting prematurely.					

## II. Statutory and Regulatory Background

### A. *Existing Reflectorization Requirements*

The Reflectorization Standards require retroreflective sheeting on the sides of rail freight rolling stock to enhance the visibility of trains. The final rule establishing the Reflectorization Standards in 2005 did not discuss how it would apply to equipment used for THEERP purposes.<sup>1</sup> By default, THEERP operations were required to comply with the Reflectorization Standards in the same manner as conventional railroads. THEERP operations did not comment during the rulemaking proceeding and FRA did not anticipate the challenges THEERP operations would encounter when attempting to bring their equipment into compliance with the Reflectorization Standards. THEERP operations began requesting relief through FRA's waiver process shortly after FRA published the Reflectorization Standards.<sup>2</sup> Their petitions for waiver explained the operational differences between THEERP entities and conventional railroads and the relative corresponding disutility of reflectorization during such operations. After more fully considering these differences, FRA granted a series of waivers excluding equipment used for THEERP purposes from the Reflectorization Standards.<sup>3</sup>

Currently, reflectorization is required to be replaced after no more than 10 years of service, regardless of its condition at the time of replacement (49 CFR 224.111). FRA's research when developing the Reflectorization Standards concluded that the durability and adhesive properties of the microprismatic retroreflective material could provide adequate luminance intensity levels and be sustained for up to 10 years with minimum maintenance.<sup>4</sup> At the time, it was not clear how the sheeting would withstand real-world railroad operating conditions or whether it could be effective for longer than

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<sup>1</sup> 70 FR 144, January 3, 2005.

<sup>2</sup> See e.g., Docket Numbers FRA-2005-2308 (Strasburg Railroad Company) and FRA-2008-0021 (Lavacot Locomotive Works).

<sup>3</sup> A list of active waivers FRA has issued to THEERP operations is available in the docket.

<sup>4</sup> 70 FR 145, January 3, 2005.



10 years. In 2015, after using the sheeting for close to 10 years, it became evident, that under certain circumstances, it could continue to perform as required beyond 10 years. To better tailor the reflectorization requirements to the actual condition of the sheeting, the railroad industry began developing an alternate method to evaluate the effectiveness of the sheeting. After successful initial results, AAR, on behalf of its member railroads, petitioned FRA for relief from the Reflectorization Standards to use an alternate method to determine when to replace the retroreflective sheeting.<sup>5</sup> FRA granted a waiver to AAR to develop alternate methods of evaluating the effectiveness of the sheeting and to implement a pilot program for in-service testing.<sup>6</sup>

B. *Waivers excluding from Part 224 Rail Freight Rolling Stock Used Only for THEERP Purposes, Except for Incidental Freight Service*

As of 2022, the Safety Board has granted relief from part 224 in response to 14 waiver petitions from 12 different railroads that operate rail freight rolling stock used exclusively for THEERP purposes. In some rare instances, the subject equipment is also used for incidental freight services when no other equipment is available. Railroads petitioned for relief, because adding retroreflective sheeting to their equipment would detract from its aesthetic or historical nature. Such equipment is typically not interchangeable, generally does not travel in the dark, and operates at low speeds and on rail lines not connected to the general railroad system. In addition, such equipment often travels over crossings protected by automatic warning gates and flashing lights, or the equipment travels over crossings at a much lower frequency than freight equipment. These operating conditions significantly reduce the benefit of retroreflective sheeting, which increases visibility of trains primarily during nighttime conditions and at passive grade crossings. When deciding these waivers, the Safety Board reviewed available

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<sup>5</sup> Docket Number FRA-2015-0105, Document No. 1 (available at <https://www.regulations.gov/document/FRA-2015-0105-0001>).

<sup>6</sup> Docket Number FRA-2015-0105, Document No. 22 (available at <https://www.regulations.gov/document/FRA-2015-0105-0022>).

records and found that the specific railroad operations and operating environments demonstrated no history of accidents at grade crossings resulting from low visibility.

While monitoring implementation of these waivers, FRA reviewed all accident and incident reports from railroads operating under the waivers, and identified no injuries or deaths that were attributable to the lack of part 224 reflectorization. Given the railroad industry's long-term success in safely operating under these waivers, FRA is proposing to codify them in part 224. This change would eliminate the need for further waivers and the associated employee hours spent on their documentation and renewal every five years.

C. *Waivers Allowing Development and Testing of Alternative Methods (Comparator Panel Evaluation) to Determine When to Replace Retroreflective Sheeting.*

On September 22, 2015, AAR petitioned FRA<sup>7</sup> for a waiver from compliance with 49 CFR 224.111. That section requires retroreflective sheeting to be replaced with new sheeting no later than 10 years after the date of initial installation, regardless of the sheeting's condition at the time of replacement. In support of the petition, AAR contracted with TTI to test and evaluate retroreflective sheeting on approximately 900 freight cars and approximately 100 locomotives in service. That testing found that generally sheeting that had been applied to rail cars more than nine years before met or exceeded the Reflectorization Standards. This data, collected in 2012 and in 2014 using a RoadVista 922 retroreflectometer,<sup>8</sup> showed the performance of the retroreflective sheeting on both rail cars and locomotives is more a function of material condition and cleanliness than it is of the amount of time passed since the application date. In particular, the sheeting demonstrated that, after more than nine years in service, it performed effectively (above the minimum thresholds outlined in Table 1 to subpart B of

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<sup>7</sup> Docket Number FRA-2015-0105, Document No. 1 (available at <https://www.regulations.gov/document/FRA-2015-0105-0001>).

<sup>8</sup> A retroreflectometer is an instrument (typically handheld) capable of accurately and reliably measuring the retroreflective properties of retroreflective sheeting materials.

part 224) and should be allowed to remain in service if properly maintained. The field data collected by AAR supported using an alternative method in lieu of the 10-year replacement cycle for retroreflective sheeting on rail freight rolling stock, provided that the sheeting is undamaged and maintained in a relatively clean condition. Thus, AAR sought a waiver to extend the replacement requirement for at least three years to develop an alternate evaluation method. On November 25, 2015, the Safety Board granted AAR relief from the 10-year replacement cycle for three years.<sup>9</sup>

A retroreflectometer, like the hand-held RoadVista 922 that AAR and TTI used to gather data in support of their waiver petition, is the most direct form of measuring sheeting's retroreflective value. Retroreflectometers are costly (approximately \$10,000 or more per unit) and are cumbersome to use, and therefore are not currently practical for regular use in a railroad shop or field environment. For a more practical option, the AAR Equipment Engineering Committee looked to the Federal Highway Administration (FHWA) Comparison Panel Method. FHWA indicates that the comparison panels are fabricated to have retroreflectivity values at or above the minimum required levels and are used to assess highway signs that have marginal retroreflectivity.<sup>10</sup> AAR proposed to develop a standard comparator panel that could be used to assess rail freight rolling stock retroreflective sheeting to the minimally required photometric performance requirements of part 224. This standard comparator panel would be fabricated to have retroreflectivity values at or above the minimum photometric values outlined in § 224.103.

After approximately three years of development, AAR finalized the design, specifications, and procedures for a standard comparator panel for evaluating the effectiveness of retroreflective sheeting on rail freight rolling stock, and on July 27, 2018, AAR petitioned FRA for final approval to use its comparator panel process in lieu of the

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<sup>9</sup> <https://www.regulations.gov/document/FRA-2015-0105-0009>.

<sup>10</sup> [https://safety.fhwa.dot.gov/roadway\\_dept/night\\_visib/sign\\_retro\\_4page.pdf](https://safety.fhwa.dot.gov/roadway_dept/night_visib/sign_retro_4page.pdf).

10-year replacement cycle.<sup>11</sup> On October 10, 2018, the Safety Board granted the petition finding that the comparator panel could be used to reliably evaluate the effectiveness of the installed retroreflective sheeting and that the design and specifications of AAR's proposed comparator panel met the minimum photometric performance requirements in § 224.103.<sup>12</sup>

### **III. Overview and Technical Discussion of Proposed Requirements**

#### *A. Proposal to Exclude from Part 224 Rail Freight Rolling Stock Used Only for THEERP Purposes, Except for Incidental Freight Service*

The Reflectorization Standards require retroreflective sheeting on the sides of rail freight rolling stock to enhance the visibility of trains. These standards were developed, generally, because low visibility, particularly at highway-rail grade crossings, can contribute to motorists colliding with rail equipment. According to data from 1992 through 2001, gathered from the FRA Office of Safety Analysis' crossing accident database, the number of accidents involving motor vehicles running into trains occupying grade crossings accidents (RIT accidents) was roughly 23% of all highway-rail grade crossing accidents. Almost 80% of these RIT accidents occurred during nighttime conditions (dusk, dawn, or darkness) and involved the highway vehicle striking the train after the first two units of the consist. Adding reflectorization to rail equipment reduces the likelihood of RIT accidents. When developing the Reflectorization Standards, FRA relied on a report from the John A. Volpe National Transportation Systems Center (Volpe Center Report)<sup>13</sup> to develop specific retroreflectivity requirements based on minimum threshold detectability levels by motorists. The Volpe Center Report defined Category 1 RIT accidents as accidents or collisions involving a highway vehicle striking the train

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<sup>11</sup> <https://www.regulations.gov/document/FRA-2015-0105-0021>.

<sup>12</sup> Docket Number FRA-2015-0105, Document No. 22 (available at <https://www.regulations.gov/document/FRA-2015-0105-0022>).

<sup>13</sup> Carroll, A. A., Multer, J., Williams, D., & Yaffee, M. A. *Safety of Highway-Railroad Grade Crossings: Freight Car Reflectorization*. DOT/FRA/ORD-98/11, John A. Volpe National Transportation Systems Center, January 1999.

after the lead unit and reported roughly 70% of the Category 1 RIT accidents (from 1975 to 1996) occurred during nighttime conditions. Category 1 RIT accidents during nighttime conditions at crossings with passive warning devices accounted for 3.0% of the total accidents during this 22-year period. This became the intended target population for the Reflectorization Standards.

The Reflectorization Standards exclude locomotives and passenger cars used exclusively in passenger service,<sup>14</sup> because generally, the conspicuity of equipment used in conventional passenger service is significantly better than the conspicuity of equipment used in freight service.<sup>15</sup> For example, highway-rail grade crossings along passenger routes are typically better protected than crossings used exclusively in freight service. Also, many passenger cars have bright exteriors or are painted in contrasting colors and are maintained in a much cleaner condition than freight cars. In addition, passenger cars typically have inside lights which are visible through the side windows that run the entire length of the car. Due to enhanced conspicuity and better protected crossings, reflectorization is not necessary for locomotives and passenger cars used exclusively for passenger service. Such equipment is currently operating without retroreflective sheeting and FRA is unaware of any accidents or incidents involving this equipment that would have been mitigated by the presence of reflectorization.

Similarly, retroreflective sheeting provides no clear safety benefit for equipment used exclusively for THEERP purposes because like other passenger equipment, equipment used exclusively for THEERP purposes is more highly visible than conventional railroad equipment and, as discussed above, is used in a more protected operating environment. For these reasons, FRA proposes to exclude equipment used for THEERP purposes from the Reflectorization Standards.

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<sup>14</sup> 49 CFR 224.3(c).

<sup>15</sup> 70 FR 149.

*B. Proposal to Allow Alternative Methods (Comparator Panel Evaluation or Retroreflectometer Measurement) to Determine When to Replace Retroreflective Sheeting.*

As noted above, in 2015, FRA granted AAR's waiver petition providing relief from the replacement requirement in § 224.111 for three years, allowing time for AAR to develop an alternate method for evaluating the effectiveness of retroreflective sheeting more than 10 years old.<sup>16</sup> AAR initially proposed to adopt a minimum performance level of 45 candela per foot-candle per square foot (cd/fc/ft<sup>2</sup>)<sup>17</sup> for a yellow comparator panel, which AAR stated was consistent with the recommendation provided by the Volpe Center Report, but did not mirror the complete specifications in § 224.103. After FRA expressed concerns about the proposed specifications, AAR agreed to develop standard comparator panels that would meet the complete minimum photometric performance requirements in § 224.103 (i.e., 45 cd/fc/ft<sup>2</sup> for yellow or fluorescent yellow sheeting and 75 cd/fc/ft<sup>2</sup> for white sheeting with a specific condition of a 30° entrance angle and a 0.5° observation angle).<sup>18</sup> Following development, FRA agreed to allow a pilot program for AAR to test the comparator panel method in service.<sup>19</sup> A trained railroad inspector would place a comparator panel immediately adjacent to, or overlapping, retroreflective sheeting installed on rail freight rolling stock, and determine its relative brightness. When the comparator panel was equal to, or brighter than, the installed sheeting, it was replaced. Testing showed the comparator panel is an accurate and easy way to determine when retroreflective sheeting needs to be replaced in compliance with the Reflectorization Standards. Similarly, a retroreflectometer device can be used to take

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<sup>16</sup> Docket Number FRA-2015-0105, Document No. 9 (available at <https://www.regulations.gov/document/FRA-2015-0105-0009>).

<sup>17</sup> The units of cd/fc/ft<sup>2</sup> are equivalent to the units of cd/lux/m<sup>2</sup> (candela per lux per square meter) and are often used interchangeably, and the Specific Intensity per unit Area (SIA) is another notation for referencing retroreflection values, which is expressed in the units above.

<sup>18</sup> Docket Number FRA-2015-0105, Document No. 10 (available at <https://www.regulations.gov/document/FRA-2015-0105-0010>).

<sup>19</sup> Docket Number FRA-2015-0105, Document No. 22 (available at <https://www.regulations.gov/document/FRA-2015-0105-0022>).

direct measurements of the sheeting and be an effective performance-based method for evaluating retroreflectivity. As such, FRA proposes to add comparator panel evaluation and direct measurements with a retroreflectometer, as alternative options to determine compliance with the Reflectorization Standards. These methods would provide flexibility for the rail industry while, in most instances, enhancing safety because allowing for alternative methods of reflectorization evaluation and replacement is a more reliable and accurate way to evaluate the effectiveness of the retroreflective sheeting than part 224's current 10-year default replacement cycle.

*1. The Existing 10-year Replacement Cycle Ensures Effective Retroreflective Sheeting, but Often Requires Replacement Sooner than Necessary*

Currently, all retroreflective sheeting, required by part 224, must be replaced with new sheeting after 10 years of service, regardless of its condition at the time of replacement. FRA established the 10--year replacement cycle based on the 10-year useful life of the sheeting according to most manufacturers.<sup>20</sup> This means the retroreflective sheeting is expected to maintain its performance for no less than 10 years. As such, sheeting that complies with the Reflectorization Standards, when installed, is expected to continue to comply throughout the 10-year cycle despite inevitable accumulations of dirt and environmental aging. This regulatory approach helps ensure rail freight rolling stock is equipped with effective retroreflective sheeting, but it may also result in railroads unnecessarily replacing sheeting that continues to be effective beyond 10 years of service.

When the initial 10-year replacement deadline approached, and in support of AAR's petition to the FRA, AAR conducted testing on retroreflective sheeting of approximately 900 railcars and approximately 100 locomotives using a RoadVista 922

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<sup>20</sup> 70 FR 157.

retroreflectometer.<sup>21</sup> The installation dates for retroreflective sheeting in the sampling were from 2005 to 2014. Based on the performance measurements, AAR believed the sheeting could continue to comply with the Reflectorization Standards for a significant amount of time beyond 10 years of service.

On January 27, 2017, AAR submitted a status report to FRA on its reflectorization waiver,<sup>22</sup> providing field measurement data for retroreflective sheeting evaluated “as is” and “after cleaning” for service ages ranging from 1 to nearly 10 years of age. Prior to AAR’s field measurements, FRA did not have any data showing the performance of retroreflective sheeting in the field, but expected it would perform at or above the minimum detectable threshold levels required by the Reflectorization Standards throughout its useful life. The data confirmed that retroreflective sheeting can perform well up to, and perhaps beyond, 10 years, especially when periodically cleaned. The data also showed that not all initially applied compliant material performs equally well throughout its anticipated useful life and can be affected by the type of service or commodity (salt, coal, chemicals, etc.) and environmental conditions (multiple freeze-thaw cycles, extreme cold or heat, high humidity, etc.) that the equipment endures. Under the more extreme of these circumstances, samples yielded measurements, after being cleaned, that were below the minimum proposed comparator panel values just 1 to 2 years after application. One cause for the poor performing samples was found to be internal degradation of the sheeting due to damage or delamination, which can lead to mold or mildew growth over the microprismatic layer. Such poor performing or internally degraded material, could be identified early on through use of the proposed comparator panel or direct measurements with a retroreflectometer, allowing for earlier

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<sup>21</sup> Docket FRA-2015-0105, Document No. 1 (available at <https://www.regulations.gov/document/FRA-2015-0105-0001>) Appendix B: Supporting Documentation from AAR Equipment Engineering Committee.

<sup>22</sup> Docket FRA-2015-0105, Document No. 23.



replacement. Overall, this would lead to better performing sheeting in service, resulting in an increase in safety compared to a blanket application of a 10-year replacement cycle.

AAR estimates the number of freight cars (not including locomotives) that would need full replacement of retroreflective sheeting based on the 10-year age limit was 283,500 freight cars in 2016, 152,000 freight cars in 2017, 149,000 freight cars in 2018, 96,500 freight cars in 2019, and 93,000 freight cars in 2020.<sup>23</sup> These figures are for freight cars only and do not include locomotives. In 2020, AAR estimated the average cost of one retroreflective sheet (4 inches by 18 inches) at \$1.31 and the average labor rate to be approximately \$141.38 per hour (\$2.36 per minute). AAR also estimated that the length of time allotted for the application of the first sheet per side of a car is 9.2642 minutes and 2.6197 minutes for each additional sheet. Assuming each freight car is equipped with a minimum 3.5 square feet of retroreflective material, this equates to a minimum of 25 minutes per side for each car. Thus, by 2020 it would have cost an estimated \$105 million or more for full replacement of retroreflective sheeting based on the 10-year age limit during that 5-year period.<sup>24</sup> The cost estimate for 2019 and 2020, alone, was approximately \$26 million. However, between the 4<sup>th</sup> quarter of 2018 through 3<sup>rd</sup> quarter of 2020 when AAR was implementing the comparator panel process, AAR estimated that 1,143,500 cars were evaluated with the comparator panel during a single-car airbrake test (SCABT) and that an average of 0.71 sheets per car was replaced for all cars under this procedure. AAR indicated that, with the comparator panel evaluation, it takes about 3.2743 minutes to clean and 2.7574 minutes to inspect retroreflective material per car (6 minutes total). Thus, the cost estimate between the 4<sup>th</sup> quarter of 2018 through 3<sup>rd</sup> quarter of 2020 for using the comparator panel during SCABT was approximately \$42

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<sup>23</sup> Docket FRA-2015-0105, Document No. 24.

<sup>24</sup>  $(774,000 \text{ freight cars}) \times [(14 \text{ sheets}) \times (\$1.31 \text{ per sheet}) + (50 \text{ minutes}) \times (\$2.36 \text{ per minute})] = \$105,527,000.$

million.<sup>25</sup> This estimate may include sheeting that was replaced as a result of being damaged, missing, or obscured during the SCABT, as required under § 224.109, and therefore does not entirely reflect the sole cost of sheeting that was replaced as a result of failing the comparator panel, and does not include the cost of the comparator panels themselves. To better understand the efficacy of the comparator panels, FRA seeks comment from the industry regarding the proportion of sheets that were replaced as a direct result of not meeting the performance criteria versus sheets that were replaced under § 224.109. When FRA granted AAR relief from the Reflectorization Standards to develop and test the comparator panel method, AAR avoided unnecessarily replacing 584,500 pieces of effective retroreflective sheeting that would have cost approximately \$79 million during those first three years. Codifying the performance-based method will avoid requiring railroads to unnecessarily replace the sheeting on approximately 1.5 million freight cars over the next 10 years.

In addition, FRA believes railroads may be unnecessarily replacing compliant retroreflective sheeting because the inspection and replacement process can be cumbersome, and detailed tracking is not required. Section 224.109 requires retroreflective sheeting to be visually inspected for presence and condition at the time of SCABT<sup>26</sup> or annual locomotive inspection and replaced at that time, if more than 20% of the required area is missing, damaged, or obscured. It is unclear to FRA, if, or how, railroads update Universal Machine Language Equipment Register (UMLER) or other records to show the date that retroreflective sheeting is replaced based on inspection results. On October 1, 2020, FRA sent an inquiry to AAR with questions regarding the reflectorization replacement process before and after the waiver was granted.<sup>27</sup> FRA

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<sup>25</sup>  $(1,143,500 \text{ freight cars}) \times [(0.71 \text{ sheets}) \times (\$1.31 \text{ per sheet}) + (6 \text{ minutes} + 9.2642 \text{ minutes}) \times (\$2.36 \text{ per minute})] = \$42,323,000.$

<sup>26</sup> AAR estimates the industry median time in 2020 between SCABT is approximately 25.6 months.

<sup>27</sup> Docket FRA-2015-0105, Document No. 24.

asked how the UMLER system is updated with the date of installation or replacement if only a portion of retroreflective sheeting is replaced during the SCABT or annual locomotive inspection. AAR responded that updates have been inconsistent because the industry no longer relies on the information provided by the UMLER fields (because relief from the 10-year replacement cycle was in place). Thus, it is FRA's understanding that the date of installation is not updated when only a portion of the minimum required sheeting area is replaced under § 224.109. Accordingly, when the 10-year replacement becomes due on the remaining retroreflective sheeting that was initially installed on a piece of rail freight rolling stock, without knowing a portion of the sheeting was recently replaced, railroads may replace the almost new retroreflective sheeting along with the retroreflective sheeting due for the 10-year replacement. In this scenario, replacing the almost new retroreflective sheeting may be premature and unnecessary per the regulation and likely without any safety benefit.

During the approximately 3-year period of relief from the 10-year replacement requirement from 2015 to 2018, and prior to AAR implementing the pilot program to test its performance-based method, the majority of retroreflective sheeting in service on AAR-member railroads was installed in 2005 and continued in service beyond 10 years. After reviewing pertinent records, FRA is unaware of any reportable RIT accidents attributable to under-performing retroreflective sheeting. Once the pilot program was approved to test the comparator panel method on in-service equipment, all sheeting on equipment within AAR interchange was evaluated using the comparator panels whenever the equipment underwent the SCABT or annual locomotive inspection, and replaced as necessary when sheeting failed the comparator evaluation. By gradually replacing retroreflective sheeting as needed, a significant amount performed effectively beyond 10 years and was allowed to continue in service beyond 10 years. These findings help

confirm AAR's conclusion that retroreflective sheeting can perform effectively beyond 10 years of service.

Thus far, only AAR-member railroads have participated in the pilot program to test the comparator panel method, but FRA anticipates additional railroads would choose to use it, if codified. In response to the public notice FRA published related to AAR's waiver petition, three commenters expressed concurrence with the proposal of an alternative method in lieu of the 10-year replacement cycle and suggested relief should be applied to all railroads.<sup>28</sup> However, FRA could not apply the relief to all railroads at that time, because not all railroads were party to the waiver petition. Thus, short line railroads, private car owners, and other entities not affiliated with AAR are still subject to the 10-year replacement cycle.

FRA believes allowing an alternative evaluation of installed retroreflective sheeting would better tailor the replacement requirements to the condition of the sheeting. The retroreflective sheeting has a finite service life and performance-based methods of evaluation will help ensure: (1) sheeting that continues to perform well after the 10 years of service can remain in service; and (2) sheeting that underperforms before the 10 years of service can be identified and replaced on a more frequent, as needed basis. FRA understands that not all railroads may benefit from the use of alternative methods because of the financial burden of procuring a comparator panel or retroreflectometer device and related training for employees, particularly for some small railroads with limited equipment. Such railroads may prefer to continue to utilize the 10-year replacement cycle. Therefore, FRA proposes to retain the 10-year replacement cycle as an option.

2. *FRA Worked Closely with AAR and TTI to Develop a Comparator Panel that Could be Used with the Reflectorization Standards*

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<sup>28</sup> Docket Number FRA-2015-0105; comments from Railroad Supply Institute, Colorado Springs Utilities, and North America Freight Car Association.

Over approximately three years, FRA worked closely with AAR and TTI to develop a comparator panel that could evaluate retroreflective sheeting and determine whether it complies with existing photometric performance requirements outlined in § 224.103. The Reflectorization Standards (Table 1 to subpart B of part 224) included minimum photometric performance requirements (*i.e.*, minimum SIA) for both yellow and white retroreflective material at observation angles of  $0.2^\circ$  and  $0.5^\circ$  and light entrance angles of  $-4^\circ$  and  $30^\circ$  based on typical grade crossing configurations and the standards in ASTM D 4956-01a.<sup>29</sup> The Volpe Center Report established that the minimum threshold SIA of 45 cd/fc/ft<sup>2</sup> is sufficient for detectability and recognition of a crossing train by an approaching motorist. This value was derived from the example of a vehicle traveling 50 mph on wet level pavement, a 2.5 second driver reaction time, and a necessary stopping distance of 500 feet to bring the vehicle to a safe stop without hitting the crossing train. In many cases, the reflected light received by the observer is reduced by three factors: the incidence (or entrance angle), the divergence (or observation) angle, and the properties of the retroreflecting material.

Appendix H of the Volpe Center Report further showed the observation angle on a level road at a detection distance of 500 feet ranges from  $0.15^\circ$  for small passenger cars to  $0.55^\circ$  for cab-over-engine trucks, as the elevation from the driver to the headlight increases. The observation angle has a greater effect on reflectivity than does the entrance angle. The entrance angle is also a function of the approach of the vehicle with respect to the crossing. Appendix H also indicated that FRA's Grade Crossing Inventory identified approximately 80% of all crossings having a crossing angle between  $60^\circ$  and  $90^\circ$ , 16% between  $30^\circ$  and  $59^\circ$ , and only 4% are between  $0^\circ$  and  $29^\circ$ . In essence, 80% of all crossings will have a vehicle (light) entrance angle of between  $0^\circ$  and  $30^\circ$  (with  $0^\circ$  being the head-on approach). Thus, the real-world scenarios outlined in the Volpe Center

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<sup>29</sup> ASTM D 4956-01a: *Standard Specification for Retroreflective Sheeting on Traffic Control*.

Report support the typical entrance and observation angles outlined in ASTM D 4956-01a for retroreflective material.

Additionally, in determining these minimum photometric performance requirements for the Reflectorization Standards, FRA extrapolated test data detailed in the Volpe Center Report out by 10 years, which is the manufacturer's stated useful life of the material. This extrapolation demonstrated that the forecasted SIA levels remained well above the minimum detection level established in the Volpe Center Report (45 cd/fc/ft<sup>2</sup>). Furthermore, Table 1 to subpart B of part 224 specifies only the minimum values, as initially applied, for the retroreflectivity values for the given combinations of entrance (-4° and 30°) and observation angles (0.2° and 0.5°). The rule does not require that these initial values be retained for any particular length of time, *e.g.*, 5 or 10 years. However, it is reasonable to expect the material to perform well up to the manufacturer's stated useful life (*i.e.*, 10 years).

AAR began the development process by applying methodology similar to FHWA's comparison panels used for evaluating retroreflective materials (discussed in section II D above). The comparator panel was constructed by adding a set of fine dot matrix markings such that the target reflectivity was achieved at the desired boundary conditions. AAR planned an evaluation process that would allow a field inspector to view the comparator panel next to, or on top of, existing sheeting from a prescribed distance away with a light source perpendicular to the plane of the sheets. AAR believed this would most likely resemble the -4° entrance angle and 0.2° observation angle configuration. Therefore, developing a comparator panel with sufficient retroreflectivity at this configuration would also inherently contain the minimum detection level (45 cd/fc/ft<sup>2</sup>) at the more oblique angles (30° entrance angle and 0.5° observation angle configuration) and would eliminate the need for a field inspector to evaluate sheeting at various angles and off center from the installed sheeting.

To find an appropriate target retroreflectivity for the comparator panel, AAR and TTI sampled part 224 compliant sheeting from various manufacturers and gathered the retroreflectivity measurements (with the 922 RoadVista) at each entrance and observation angle configuration. Correlation ratios were obtained between the two entrance angles ( $-4^{\circ}$  and  $30^{\circ}$ ) for each corresponding observation angle ( $0.2^{\circ}$  and  $0.5^{\circ}$ ) for all the samples. The lowest correlation ratio between all samples of 0.50 was then applied to the minimum threshold retroreflectivity of  $45 \text{ cd/fc/ft}^2$ , which relates to the  $30^{\circ}$  entrance angle, to obtain a corresponding retroreflectivity value at the  $-4^{\circ}$  entrance angle. Because the apparent surface area of sheeting reduces as the angle at which it is viewed increases, a cosine correction factor was applied to compensate for the reduction of apparent size at the  $30^{\circ}$  entrance angle compared to  $-4^{\circ}$  entrance angle. A standard sheet of reflectorization is typically 4-inches by 18-inches and has a total surface area of 72 square inches, but when viewed from 30 degrees off normal the apparent surface area is reduced to approximately 85% of the true total surface area, or 62 square inches. Taking the correlation ratio and cosine correction into consideration and applying it to the minimum threshold retroreflectivity of  $45 \text{ cd/fc/ft}^2$ , a minimum retroreflectivity value is obtained at for the  $-4^{\circ}$  entrance angle and  $0.2^{\circ}$  observation angle configuration for a yellow comparator panel. To provide some assurance that the applied sheeting being evaluated remains suitable for a period after the SCABT or locomotive annual inspection is performed, AAR and FRA agree upon a minimum threshold value of  $150 \text{ cd/fc/ft}^2$  (or  $\text{cd/lux/m}^2$ ). Also, to make manufacturing the comparator panel more feasible, a range was provided which set a maximum at  $170 \text{ cd/fc/ft}^2$ . The same methodology was applied to obtain the minimum retroreflectivity values for a white comparator panel which corresponded to minimum retroreflectivity value of  $250 \text{ cd/fc/ft}^2$  and a maximum of  $285 \text{ cd/fc/ft}^2$  for the  $-4^{\circ}$  entrance angle and  $0.2^{\circ}$  observation angle configuration.

Both AAR and FRA felt it was necessary to define what the minimum retroreflectivity value is for the 30° entrance angle and 0.5° observation angle configuration because the comparator panels are typically manufactured by adding fine dot matrix layers to part 224 compliant reflectorization to reduce the overall retroreflectivity and achieve the desired level of retroreflectivity. This ensured that while the overall retroreflectivity was being reduced at the -4° entrance angle and 0.2° observation angle configuration to a target retroreflectivity value of 150 cd/fc/ft<sup>2</sup>, it did not inadvertently drop below 45 cd/fc/ft<sup>2</sup> for the 30° entrance angle and 0.5° observation angle configuration. As previously mentioned, the existing Reflectorization Standards do not require that all initial retroreflectivity values be retained for a set period; however, it is reasonable to expect the sheeting to perform as intended for its useful life. Industry practice requires that the sheeting retain at least 80% of its initial values when subjected to 36 months of accelerated weathering.<sup>30</sup> Therefore, both AAR and FRA felt it was reasonable to require the comparator panels to have 80% of the minimum retroreflectivity value at the 30° entrance angle and 0.5° observation angle configuration, or 35 cd/fc/ft<sup>2</sup> for yellow panels and 60 cd/fc/ft<sup>2</sup> for white panels.

With the specifications for the retroreflective comparator panels established, AAR solicited samples from various retroreflective sheeting manufacturers made to the comparator panel specifications. AAR procured six sample comparator panels from one manufacture for evaluation and took measurements of the retroreflectivity with the 922 RoadVista. The results show that the six samples of comparator panels average an SIA value of about 160 cd/fc/ft<sup>2</sup> at the -4°/0.2° configuration and about 55 cd/fc/ft<sup>2</sup> at the 30°/0.5° configuration. While these values were from one single manufacturer, both AAR and FRA were confident that the specifications outlined for the comparator panel could be achieved from other manufacturers as well.

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<sup>30</sup> ASTM D 4956-01a: *Standard Specification for Retroreflective Sheeting on Traffic Control*.



3. *FRA Approved a Pilot Program to Test AAR's Standard S-916; Retroreflective Comparator Panel Requirements(S-916) in Service.*

On July 27, 2018, AAR petitioned FRA for approval of a pilot program to test its newly developed standard comparator panel and process for using it to evaluate retroreflective sheeting for compliance with the Reflectorization Standards instead of the 10-year replacement cycle required by § 224.111.<sup>31</sup> The Safety Board found the design and specifications of AAR's proposed comparator panel were acceptable and noted that when viewed at -4° entrance angle and 0.2° observation angle (-4°/0.2°), the comparative panel achieved the equivalent minimum detectable SIA, as referenced in the Volpe Center Report (45 cd/fc/ft<sup>2</sup> for yellow material or 75 cd/fc/ft<sup>2</sup> for white material), at an entrance angle of 30° and observation angle of 0.5° (30°/0.5°), or reasonably at a service worn estimate of 80 percent of these values. On October 10, 2018, the Safety Board approved of AAR's proposed pilot program.<sup>32</sup> To facilitate the pilot program, AAR finalized and adopted AAR Standard S-916, *Retroreflective Comparator Panel Requirements*, prescribing the requirements for comparator panels to be used in the performance evaluation of retroreflective sheeting on freight cars and locomotives. The pilot program is currently ongoing. Throughout the pilot program, within AAR interchange, comparator panel evaluations have been, and will continue to be, required for all retroreflective sheeting on freights cars during each SCABT and on locomotives during each annual inspection.

Currently, Table 3.1 of S-916 provides the following specifications for a comparator panel:

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<sup>31</sup> Docket FRA-2015-0105, Document No. 21.

<sup>32</sup> Docket FRA-2015-0105, Document No. 22.

**Table 3.1 Retroreflectivity requirements**

Color	Required Retroreflectivity (cd/lx/m <sup>2</sup> ) at -4° entrance and of 0.2° observation angles		Required Retroreflectivity (cd/lx/m <sup>2</sup> ) at 30° entrance and of 0.5° observation angles
	Minimum	Maximum	Minimum
White	250	285	60
Yellow	150	170	35

In addition to the retroreflectivity specifications, S-916 also provided a comprehensive list of other aspects of the comparator panel. To maintain sufficient surface area for retroreflectivity, and for ease of use and versatile placement of the comparator panel on various parts of rail freight rolling stock, S-916 specifies that the retroreflective surface of the panels shall measure 4 inches by 4 inches and be equipped with a magnetic backing. Unlike the microprismatic retroreflective material required for rail freight rolling stock, the comparator panels shall be constructed of glass-beaded material or other material that displays uniform appearance when rotated and viewed with a light source. Because part 224 allows for horizontal and vertical placement of retroreflective sheeting, this helps eliminate the slight directional dependency of the panel that would otherwise be exhibited in prismatic material; however, this does not diminish the amount of retroreflectivity for the same given value.

AAR and FRA agreed that the comparator panels would need to contain pertinent information about the panel so that individuals using the panel could easily verify it was valid, *i.e.*, calibrated and/or certified. Thus, as a condition of FRA's approval of the comparator panels, FRA required the panels to have a waterproof and dust-proof label on the back side that contained the phrase "Retroreflective Comparator Panel – Yellow" or "Retroreflective Comparator Panel – White;" and the name of the manufacturer, the part, model, or serial number, the date the panel was manufactured, the target retroreflectivity level to which the panel was manufactured (measured in cd/lx/m<sup>2</sup>), and a space provided for future recalibration date sticker(s). FRA and AAR concluded that a recalibration sticker would help ensure the panels stay within the specified retroreflectivity levels.

Initially, an expiration date was considered, however, setting an expiration on a comparator panel that may continue to function as intended is contrary to the purpose for developing comparator panels to evaluate the sheeting. Thus, AAR built a recalibration requirement into S-916, to ensure that comparator panels are checked or recalibrated periodically to confirm they remain within the manufactured specifications for continued use. Specifically, S-916 requires the use of a sticker attached to the back of each comparator panel with a recalibration date specified.

To help implement its comparator panel standard, AAR published Specification M-944, *Retroreflective Sheeting Inspection Procedure* (M-944). M-944 provides the process for conducting a performance evaluation of retroreflective sheeting on railroad freight cars and locomotives using a comparator panel or electronic handheld retroreflectometer. An initial inspection of the car or locomotive includes cleaning and examination of sheeting with a light source approximately 15 feet away as a preliminary screening to determine if further inspection is necessary. If the perceived reflected light intensity of the entire installed sheeting appears brighter than that of the comparator panel, it does not need to be further evaluated with the comparator panel. Sheeting that has signs of condemnable degradation (*i.e.*, internal mold or mildew growth) also do not need to be further evaluated with the comparator panel, as they are simply replaced. If the perceived reflected light intensity of the entire installed sheeting does not appear brighter than that of the comparator panel and does not have signs of condemnable degradation (typically exhibiting dull or otherwise questionable retroreflectivity) it is evaluated by a comparator panel for evaluation (or a handheld retroreflectometer). The comparator panel is placed adjacent to or overlapping the target sheeting, and both are evaluated with a light source adjacent to the inspector's eye and from approximately 15 feet away. Sheeting that appears brighter than the comparator panel does not need to be further evaluated and does not need to be replaced. If the comparator panel appears

brighter than the sheeting, or if the inspector cannot distinguish one as being brighter than the other, the sheeting shall be replaced. A handheld annular retroreflectometer can also be used to directly evaluate sheeting. The minimum retroreflective value to continue in service is 150 cd/lux/m<sup>2</sup> for yellow sheeting and 250 cd/lux/m<sup>2</sup> for white sheeting, when measured at -4° entrance angle and 0.2° observation angle. Sheeting that yields retroreflective values below these minimums shall be replaced.

AAR incorporated the specifications of the comparator card and inspection procedures into AAR Interchange Rule 66, *Reflective Sheeting*. Rule 66 also established a new billing repair “Why Made Code: 1F” related to use of the comparator panel and replacing reflective sheeting for not meeting the minimum reflectivity levels per Rule 66. The existing “Why Made Code: 49” is still valid for reflective sheeting lacking FRA-224 stamp, damaged, obscured, or missing, for use with Job Codes 5500 and 5502. FRA seeks comment from AAR regarding the proportion of “Why Made Code: 1F” to “Why Made Code: 49” that was billed during freight car SCABT or locomotive annual inspection.

Since late 2018, AAR’s alternate method has been widely used by industry (specifically within interchange among AAR member railroads). FRA understands the standard has been successful and has no record of accidents, incidents, or violations related using the standard. FRA is proposing to codify the current elements of the standard in this rulemaking proceeding and requests comments on whether the elements of the standard should be codified to continue use of the standard for complying with part 224 and make it an option for the entire railroad industry.

#### **IV. Section-by-Section Analysis**

##### **Section        224.3 Applicability**

Section 224.3 sets forth the scope and application of part 224. Part 224 generally applies to all railroad freight cars and locomotives that operate over a public or private

highway-rail grade crossing and are used for revenue or work train service. Existing paragraphs (a) through (d) of § 224.3 exclude from part 224's applicability, certain types of equipment and operations because they present a low risk of RIT collisions. FRA proposes to add paragraph (e) to exclude rail freight rolling stock used solely for THEERP purposes, except for incidental freight service. FRA is proposing to exclude equipment used only for THEERP purposes because (as discussed further in Section II C. and III A. of the supplementary materials above) those operations present a low risk of RIT collisions. Incidental freight service would include when a railroad uses rail freight rolling stock for other than THEERP purposes only on rare occasions as necessary to facilitate some of their operations. For example, California State Railroad Museum requested relief from part 224 for two locomotives used primarily for yard switching, freight service, and rarely in passenger (excursion) train service, but only when its steam locomotives fail.<sup>33</sup> In another instance, The Everett Railroad Company stated that its caboose car is retained primarily for use on excursion trains, historical and public relation events, along with possible, but very infrequent, use as a crew caboose or shoving platform.<sup>34</sup> For these particular instances, the freight train consist, as well as the railroad trackage, are short, and the trains operate at much lower speeds than typical freight service.

#### Section 224.107 Implementation Schedule

FRA proposes to remove this section. On November 28, 2005, when the Reflectorization Standards took effect, railroads operating rail freight rolling stock subject to this part, were required to commit to an implementation schedule for equipping their fleet with reflectorization. This section required such railroads to submit an implementation schedule to FRA for approval, or adopt FRA's proposed implementation

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<sup>33</sup> Docket FRA-2010-0171, Document No. 9.

<sup>34</sup> Docket FRA-2012-0024, Document No. 4.

schedule, equipping 10% of total freight fleet per year for 10 years, and 20% of total locomotive fleet per year for 5 years. This meant that by November 28, 2015, 100% of the freight fleet population would be fully equipped with part 224 compliant retroreflective sheeting. Similarly, by November 28, 2010, 100% of the locomotive fleet population would be fully equipped with part 224 compliant retroreflective sheeting. With the passage of time, railroads are no longer required to submit an implementation schedule or adopt FRA's proposed implementation schedule. Therefore, this section is outdated and FRA is proposing to remove the language to shorten and simplify part 224.

#### Section 224.109      Inspection, repair, and replacement

FRA proposes to revise paragraphs (a) and (b) to remove any references to § 224.107, because that section's requirements are outdated, and in this rulemaking proceeding FRA is proposing to remove it. Specifically, FRA proposes to remove the following language “(§ 224.107 in the case of freight cars subject to § 224.107(a)(3))” from paragraph (a), and the following language “(§ 224.107 in the case of locomotives subject to § 224.107(b)(3))” from paragraph (b).

#### Section 224.111      Renewal

FRA proposes to retitle this section from “Renewal” to “Evaluation, and replacement of 10-year old or underperforming retroreflective sheeting.” The existing title, “Renewal,” reflects the only current replacement option, which is to renew the retroreflective sheeting after 10 years, regardless its condition. The proposed title would indicate two options for replacing the retroreflective sheeting: the same 10-year replacement cycle; or using a performance-based method to determine when replacement is required.

In paragraph (a), FRA proposes to identify two options for replacing retroreflective sheeting: a 10-year replacement cycle; and an alternative method to

determine when replacement is required. FRA proposes to include the existing 10-year replacement option in paragraph (b) and the alternative option in paragraph (c).

FRA proposes to retain the 10-year replacement option in paragraph (b), because some short line railroads or individual car owners may not want to invest in the equipment and training needed to switch to an alternative method. As discussed above, it is not clear if, or how, railroads are able to distinguish between replacement sheeting and previously installed sheeting on the same piece of equipment. According to AAR, UMLER system updates have been inconsistent, because the railroad industry no longer relies on the information provided by the UMLER fields. FRA requests comment from the railroad industry on how records are created and maintained to track the installation date of sheeting when only a portion of the required sheeting is replaced prior to 10-years from the date of original installation.

Proposed paragraph (c) would require railroads to evaluate retroreflective sheeting during the SCABT and annual locomotive inspection. Proposed paragraph (c)(1) provides the specifications for an acceptable comparator panel to carry out the evaluation. Proposed paragraph (c)(2) sets forth the process and criteria for evaluating the existing sheeting using a comparator panel under paragraph (c)(1). Proposed paragraph (c)(3) permits the use of a handheld retroreflectometer to perform the required evaluation. As part of FRA's routine compliance oversight, the agency expects to review railroads' inspection records to verify an alternative evaluation was conducted.

As proposed, the retroreflectivity, color, and construction requirements in paragraph (c)(1)(i) through (iii) are the same as the current S-916. The proposed labeling requirement in subparagraph (c)(1)(iv) is also the same as the current S-916, with the additional requirement that a panel's label include information on the calibration status of the panel. Since AAR indicated that the median time between SCABT is 25.6 months, FRA proposes to have the comparator panels recalibrated at least every two years (*i.e.*, no

more than two years from its manufactured date or previous recalibration date, whichever is most recent). FRA seeks comment on this proposed timeframe and how much downtime is expected while a panel is out for recalibration.

Proposed paragraph (c)(2) would establish the same comparator panel evaluation process and criteria as the current M-944. M-944 recommends evaluating installed sheeting with a comparator panel from 15 feet. FRA understands that 15 feet provides an appropriate amount of space to perform the evaluation, but also understands that during a SCABT or locomotive annual inspection it may not be practicable for an inspector to stand 15 feet from the equipment. To provide some flexibility, proposed paragraph (c)(2)(iv) would require sheeting to be evaluated from a distance of between 10 and 20 feet, with a 15-foot distance being preferable. FRA seeks comments on whether a range of 10 to 20 feet is sufficient to properly evaluate retroreflective sheeting and whether the proposed range provides sufficient flexibility.

Consistent with M-944, proposed paragraph (c)(2)(v) sets forth the process for conducting the evaluation (*e.g.*, with light source positioned adjacent to the inspector's eye and directed at the sheeting and comparator panel, the inspector compares the reflected light intensity of the entire installed sheeting to that of the comparator panel). Proposed paragraph (c)(2)(v)(A) provides that if the perceived reflected light intensity of the entire installed sheeting appears brighter than that of the comparator panel, the installed sheeting passes the evaluation. Proposed paragraph (c)(2)(v)(B) provides that if the perceived reflected light intensity of the entire installed sheeting does not appear brighter than the comparator panel or if the two are indistinguishable, the installed sheeting, does not pass the evaluation. If the two are indistinguishable, the installed sheeting is already at or near the minimum threshold to comply with this section and would only continue to degrade below the threshold if allowed to continue in service until



the next evaluation required by this section. Therefore, as proposed, FRA would require such sheeting to be replaced.

In paragraph (c)(3), FRA proposes to allow the use of handheld reflectometers to evaluate retroreflective sheeting and determine when it is required to be replaced under this part. FRA understands that reflectometers can be used to evaluate retroreflective sheeting easily, reliably, and accurately. Proposed paragraph (c)(3) would require use of an annular reflectometer, placed directly against the retroreflective sheeting. FRA is requiring an annular device, if a reflectometer is used, because it is easier to ensure an accurate evaluation compared to other types of devices that require multiple measurements from different angles to properly evaluate the sheeting. Proposed paragraph (c)(3)(iii) sets forth the minimum allowable retroreflective values and necessary measurement angles if a reflectometer is used. Due to the current high cost of a handheld reflectometer, FRA does not anticipate widespread use of reflectometers initially. However, if the cost diminishes overtime, railroads may prefer it.

## **V. Regulatory Impact and Notices**

### **A. Executive Order 12866**

The proposed rule is a nonsignificant regulatory action under Executive Order 12866, “Regulatory Planning and Review.” FRA made this determination as the economic effects of the proposed rulemaking would not exceed the \$100 million annual threshold defined by Executive Order 12866. FRA estimates this proposed rule would result in benefits over a 20-year period from not replacing retroreflective sheeting prior to the end of its useful life, while potentially improving safety by replacing in less than 10 years sheeting that has already reached the end of its useful life.

#### *1. Need for Regulatory Action*

The Reflectorization Standards were promulgated in 2005; in the over-15 years since their publication, FRA has learned that the reflective sheeting applied to rail freight

rolling stock can remain effective beyond the 10 years initially thought at the time the Reflectorization Standards were developed. This rulemaking updates the Reflectorization Standards in light of this new information by allowing the use of an alternative method to evaluate retroreflective sheeting. The alternative method, currently implemented by using a comparator panel (under waiver), allows railroads and private car owners to replace retroreflective sheeting as needed, based on performance, instead of a mandatory replacement based on length of time. The proposed rule also recognizes a segment of the regulated entities that operate THEERP freight rolling stock and extends the exclusion from the Reflectorization Standards to THEERP operations, as they pose a low risk of highway-rail grade crossing incidents. For both stakeholders that choose to use the comparator panel, and those that operate THEERP freight rolling stock, the proposed rule promotes regulatory certainty and efficiency. Unnecessary paperwork burdens would also be reduced by no longer needing to periodically file waivers with FRA for relief from their respective sections of part 224.

The proposed rulemaking amends part 224 in two substantive ways. First, the proposed rule codifies waivers excepting THEERP operations from reflectivity standards in § 224.3. Second, the proposed rule codifies the AAR waiver allowing railroads to use an alternative method (*i.e.*, the comparator panel) for determining when retroreflective sheeting needs replacement. The comparator panel would be added as an option to the existing 10-year replacement cycle under § 224.111.

## 2. *Baseline*

The typical baseline scenario from which benefits and costs of the regulation are measured is the no-action baseline, which is an assessment of the railroad world without the proposed rule.<sup>35</sup> Without the NPRM, it is likely that the railroads will continue to file

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<sup>35</sup> Office of Management and Budget (OMB), *Circular A-4: Regulatory Analysis* (Sept. 17, 2003). Available: <https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf>.

waivers and waiver renewals for using the alternative method and exclusion of THEERP freight rolling stock from the Reflectorization Standards. One possible baseline would assume FRA approves most of these waivers with conditions, as it has in the past. In comparing this baseline to the NPRM, the benefit from the NPRM would be the removal of unnecessary paperwork burdens of having to file future waivers and renewals with FRA.

However, another baseline might offer more information about the impacts of the proposed rule. The waiver to use the comparator panel is relatively recent (2018), and many of the THEERP waivers are also less than 10 years old. The comparator-panel waiver covers almost all the rail freight rolling stock. Another baseline would describe a scenario absent the comparator-panel waiver, that is, in which approval of the waiver is uncertain and reflective sheeting is replaced per the 10-year renewal cycle in existing § 224.111. FRA proposes to use this baseline to better estimate the substantive impacts of the NPRM. The baseline is accounted for as a separate alternative under the Costs section below. FRA invites comment on the appropriate baseline to use for the regulatory analysis.

### *3. Costs*

#### *a. Methodology*

Since the retroreflective sheeting is applied per rail car, this analysis used the per-car cost as the basis to estimate much of the costs related to retroreflective sheeting. The costs for preparing waiver petitions were estimated based on the labor costs of those employees preparing the waivers.

FRA requested data from AAR about the railroads' experiences under the approved waiver using the comparator panel. FRA reviewed the data supplied by AAR

and incorporated it into the cost estimates below. AAR provided data for before and after the comparator panel waiver.<sup>36</sup>

In its estimates, AAR used an average labor rate of \$140.38 per hour or \$2.34 per minute, in 2020 dollars, which may be based on interchange billing rates. For its regulatory analyses, however, FRA uses standardized labor rates which the Class I railroads report to the Surface Transportation Board (STB). These rates are burdened by 75 percent for any fringe benefits. (The Class I railroads report service hours and compensation to STB under 49 CFR 1245.2.) For this analysis FRA used the STB wage rates for the relevant employee groups. These are STB Group 200 employees consisting of Executives, Officials, & Staff Assistants who likely complete waiver petitions for the railroads, and Group 400 Maintenance of Equipment & Stores employees who inspect and apply the reflective sheeting. The Executives, Officials, & Staff Assistants burdened rate is \$77.44 per hour or \$1.29 per minute, and the Maintenance of Equipment & Stores employees burdened rate is \$59.89 per hour or \$1.00 per minute (in 2020 dollars).<sup>37</sup>

To estimate Government costs and benefits resulting from reviewing and approving waivers, FRA used the General Schedule (GS) pay rates for grade GS-14 step 5 employees in the Washington, DC area. The Federal pay rate was also burdened by 75 percent yielding a Federal pay rate of \$115.29 per hour.<sup>38</sup>

AAR provided counts of the maintenance of way (MOW) cars and locomotives that would be covered under part 224; however, FRA focused on freight rail cars to simplify the analysis. Given that MOW cars and locomotives represent a small portion of

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<sup>36</sup> Association of American Railroads (AAR), *FRA Data Request for Docket FRA-2015-0105* (Nov. 3, 2020).

<sup>37</sup> Surface Transportation Board (STB), *Quarterly Wage A&B Data* (2020). Annual composite for All Railroads. Available: <https://www.stb.gov/reports-data/economic-data/quarterly-wage-ab-data/>. Calculations: For Group 200 employees, \$44.25 per hour STB average straight time rate x 1.75 fringe benefit multiplier = \$77.44 per hour burdened wage rate. Similarly, for Group 400 employees, \$34.22 x 1.75 = \$59.89 per hour burdened wage rate.

<sup>38</sup> Office of Personnel Management (OPM), *Salary Table 2020-DCB* (Jan. 2020). Available: [https://www.opm.gov/policy-data-oversight/pay-leave/salaries-wages/salary-tables/pdf/2020/DCB\\_h.pdf](https://www.opm.gov/policy-data-oversight/pay-leave/salaries-wages/salary-tables/pdf/2020/DCB_h.pdf). Calculation: \$65.88 per hour GS-14 Step 5 rate x 1.75 fringe benefit multiplier = \$115.29 per hour burdened rate.

all freight rail cars (about 2.5 percent and 1.6 percent respectively), including them in the analysis would not significantly affect the results.

FRA used a 20-year period of analysis for this rulemaking because retroreflective sheeting appears to have an effective service life beyond 10 years (based on data from the AAR comparator panel waiver). FRA also identified one study that estimated prismatic sheeting used on traffic signs may last 15 to 30 years, which may be a reasonable proxy for similar sheeting used on rail cars.<sup>39</sup> However, for the rail freight rolling stock used in THEERP operations, a 10-year period of analysis may be a better “fit” because overage equipment may only be actively used for an additional 5 to 10 years. Since the provision permitting use of the comparator panel covers most of the rail car fleet, FRA chose to use a 20-year period of analysis.

First, the baseline scenario costs were determined, followed by the NPRM costs. The difference between the two costs represents the estimated net benefits (or costs) of the NPRM: *Baseline costs - NPRM costs = Net benefits (or costs)*.

The costs and benefits associated with the NPRM are summarized in Table V-1 below.

**Table V-1: Summary of Total Benefits over the 20-Year Period (2020 Dollars)**

<b>Impact</b>	<b>Undiscounted</b>	<b>Present Value 7%</b>	<b>Present Value 3%</b>	<b>Annualized 7%</b>	<b>Annualized 3%</b>
<b>Baseline Cost</b>	\$540,747,953	\$286,435,001	\$402,248,463	\$27,037,438	\$27,037,415
<b>NPRM Cost</b>	\$436,091,940	\$231,038,590	\$324,420,840	\$21,808,408	\$21,806,176
<b>Net Benefits</b>	<b>\$104,656,013</b>	<b>\$55,396,411</b>	<b>\$77,827,623</b>	<b>\$5,229,029</b>	<b>\$5,231,239</b>
Government Costs for Waivers (Baseline)	\$167,171	\$89,183	\$124,739	\$8,418	\$8,384
Qualitative Benefit: Reduced environmental waste from not replacing effective reflective sheeting prematurely.					

The impacts are described in detail below.

<sup>39</sup> Preston, Howard, *Traffic Sign Life Expectancy* (St. Paul, MN: 2014). Report No. MN/RC 2014-20. Minnesota Dept. of Transportation. Available: <https://www.lrrb.org/pdf/201420.pdf>.

b. *Baseline Costs*

Absent this NPRM, both THEERP operations and other railroads to which the Reflectorization Standards apply will incur costs for the following requirements:

- Cost for inspection and replacement of missing, damaged, or obscured retroreflective sheeting (“sheeting”) under § 224.109.
- Cost to renew, i.e., replace sheeting no later than 10 years after installation under § 224.111. The baseline assumes sheeting will be replaced periodically every 10 years.
- Incidental cost for transporting rail cars that would not typically appear on a repair track or shop for a SCABT to renew sheeting under § 224.111.
- Cost of petitioning FRA for waivers from the Reflectorization Standards.

These cost elements may be represented by the equation: *Baseline cost = Visual inspection & sheeting replacement + 10-year renewal + Transport + Waiver.*

The cost for inspection and replacement of missing, damaged, or obscured sheeting was determined by the cost of a visual inspection and sheeting replacement multiplied by the number of cars undergoing a SCABT. The SCABT serves as the triggering event for the inspection and replacement of sheeting under § 224.109. To determine the number of cars undergoing a SCABT per month, FRA used the median time between SCABTs of 25.6 months, and the average annual number of freight cars of 1,658,334 (an average over the recent period 2016-2020). The cars per month were multiplied by 12 months to yield an estimated 765,385 cars per year undergoing a SCABT.<sup>40</sup>

Further, the cost of the visual inspection and sheeting replacement was determined by the sum of the cost of the visual inspection and cost to replace missing, damaged, or obscured sheeting. AAR indicated the time for a visual inspection was 0.83 minutes, the time to replace the first sheet per side was 9.3 minutes, the average number of sheets replaced during SCABTs was 0.71 sheets, and the cost per sheet was \$1.31.

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<sup>40</sup> Calculation: 1,658,334 fleet size/26 months = 63,782 SCABT cars per month. Then 63,782 cars per month x 12 months = 765,385 cars per year that undergo a SCABT, or about 46% of the fleet. Source: *FRA Data Request*, 2020.

Accounting for the labor time using the STB Maintenance of Equipment & Stores wage rate of \$1.00 per minute results in a per-car cost of \$11.00. Then the cost under § 224.109 was calculated by multiplying the estimated cars undergoing a SCABT by the cost per car, resulting in a cost of \$8,423,025 per year.<sup>41</sup>

Similarly, the cost to renew the sheeting after 10 years was determined by the number of cars affected multiplied by the cost of renewal. The average number of cars that would need full renewal was 154,800 per year based on the average over the years 2016 to 2020 (*FRA Data Request*, 2020). That represents about 10 percent of the fleet per year, which is expected given the 10-year renewal period. The cost for sheeting material per car was estimated given 14 sheets (of 0.5 square-foot each) would be needed for 2 sides of the rail car (less than 50-foot car, 7 sheets per side), for a cost of \$18.34 per car. AAR provided that the time to apply the sheeting was 9.3 minutes for the first sheet per side, and 2.6 minutes for each additional sheet, totaling almost 50 minutes for both sides of a rail car and \$50 in labor costs (using the STB Maintenance of Equipment & Stores wage rate of \$1.00 per minute). The cost per car for sheeting renewal is the sum of the material cost and labor application costs ( $\$18.34 + \$49.87 = \$68.21$  per car). Then the renewal cost for all affected cars is \$10,558,758 annually.<sup>42</sup>

In order to model the impacts more accurately under the baseline, FRA estimated the potential costs for transporting rail cars, that in their normal operations, would not appear on a repair track or shop (for a SCABT). These cars may be owned by private car owners that do not own repair shops, MOW cars that are not regularly interchanged, older cars that are not regularly interchanged, stored cars, and seasonally used cars. These cars may incur additional expense for transportation to a repair shop when their sheeting

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<sup>41</sup> Calculations: Per-car cost for visual inspection and sheet replacement = 0.83 min. x \$1 per min. visual inspection + 9.3 min. x \$1 per min. sheeting replacement + 0.71 sheets x \$1.31 per sheet = \$11.00. Total cost for visual inspection and sheeting replacement = 765,385 cars x \$11 per car = \$8,423,025 per year.

<sup>42</sup> Calculation: Cost to renew sheeting after 10 years = 154,800 cars x \$68.21 per car = \$10,558,758 per year on average.

needs renewal after 10 years. However, this situation is mitigated by mobile repair units or a railroad's Running Repair Agent (RRA) that can perform SCABTs and replace sheeting.<sup>43</sup> Nevertheless, FRA accounted for the transportation costs for some cars that may need to be moved for sheeting replacement because of scheduling issues with mobile repair agents or operational issues. As a proxy estimate for the number of cars requiring transport, FRA used the 23,000 freight cars that have interchange restrictions as reported by AAR; these cars are usually older cars.<sup>44</sup> Another way to estimate the number of affected cars is to consider the conditional probability of not undergoing a SCABT on a repair track or shop and cars that would need full sheeting renewal. The probability of not undergoing a SCABT was found by dividing the number of cars undergoing a SCABT by the average fleet size, then subtracting from 1, for a result of 0.54 or about 50 percent.<sup>45</sup> From the discussion above, the probability of renewal for a car is about 10 percent or 0.1. The conditional probability is the product of the two probabilities, equaling about 0.05 or 5 percent of the fleet, and representing 89,295 rail cars. Qualitatively, the majority of these cars can be serviced by mobile repair agents and RRAs, and FRA used 23,000 cars as a reasonable estimate.

For the transportation cost per car, FRA estimated the expected transportation cost as the probability that a car would need transportation for sheeting renewal multiplied by its transportation cost. FRA estimated a range of \$3,000 for \$4,000 to transport an empty car, or an average cost of \$3,500 per car; the expected cost in any one year is \$350.<sup>46</sup> Then, the transportation cost for the rail car fleet is the estimated 23,000 affected cars multiplied by the expected transportation cost of \$350, for an overall transportation cost of \$8,050,000 annually. Given the uncertainty about the number of cars affected, there is

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<sup>43</sup> Railinc, *Running Repair Agents – Active*. Available: <https://findusrail.railinc.com/#/home>.

<sup>44</sup> AAR, *Railroad Facts: 2020 Edition* (Washington: 2020) 53.

<sup>45</sup> Calculation:  $1 - 765,385 \text{ SCABT cars} / 1,658,334 \text{ average fleet size} = 1 - 0.46 = 0.54$ , or about 50 percent of cars not likely to appear on a repair track or shop for a SCABT.

<sup>46</sup> Calculation: Expected(transportation cost per car) = probability(car would need 10-year sheeting renewal) x transportation cost =  $0.1 \times \$3,500 = \$350$ .



a higher degree of uncertainty about this cost estimate and FRA invites comment on the inputs used.

The last cost element in the baseline scenario is the cost of petitioning FRA for waivers from the Reflectorization Standards. When approved, waivers generally provide regulatory relief for five years. For this analysis, FRA distinguished between waiver extensions and waiver renewals. Waivers extensions permit the railroad or individual car owners to continue to operate under the original waiver for another five years, and do not require preparation of a **Federal Register** notice. After 10 years, the railroad or individual car owner can no longer apply for an extension, but must instead request a renewal of the waiver. The renewal requires more administrative tasks including a **Federal Register** notice. The baseline waiver cost is the estimated number of new waivers plus waiver extensions and renewals, multiplied by the cost of filing waivers. This analysis estimated the waiver costs for both THEERP operations and the performance-based (i.e., comparator-panel) waiver.

In the case of waivers for THEERP operations, FRA has received and reviewed 22 waivers over 16 years, for a rate of 1.375 new waivers per year, which is rounded to 1.5 waivers for analysis. Therefore, over the 20-year period of analysis (years 2022 to 2041), FRA expects 30 new waiver petitions. Based on historical experience and FRA subject matter expert estimates, FRA has found that waiver extensions and renewals are subject to the following three conditions:

- Railroads or individual car owners will likely not operate overage equipment beyond 10 years.
- Railroads or individual car owners have not asked for renewals of waivers beyond 10 years.
- FRA has approved 14 out of 22 waivers for an approval rate of 64 percent (i.e., 64 percent of 1.5 new waivers is about 1 new waiver per year). Moreover, there were 7 dismissed or denied waivers, and 1 double-counted waiver to complete the set of 22 THEERP waivers).

Applying these conditions to the number of new waivers, FRA estimated 15 waiver extensions over the period of analysis. As explanation, new waivers approved

during years 1 through 5 of the period of analysis (from calendar years 2022 through 2026) will likely receive extensions during years 6 through 10 of the period of analysis (from calendar years 2027 through 2031) respectively, resulting in 5 extensions. (After 10 years, requests for waivers renewals are not likely under the first two conditions above.) Similarly, new waivers approved during years 6 through 10 of the analysis will likely receive extensions during years 11 through 15 of the analysis (from 2032 through 2036) respectively, resulting in an additional 5 extensions. Finally, new waivers approved during years 11 through 15 of the analysis will likely receive extensions during years 16 through 20 of the analysis (from 2037 through 2041) respectively, resulting in 5 more extensions. In total, FRA expects 15 waiver extensions.

Also, THEERP operations that currently have waivers may request extensions resulting in an additional 6 waiver extensions. Of the 14 approved THEERP waivers, 4 did not request a waiver renewal and expired before year 2022 (waivers FRA-2010-0148, 2010-0156, 2008-0021, and 2014-0082). Of the remaining 10 approved THEERP waivers, 1 is due for an extension in year 1 of the analysis, *i.e.*, calendar year 2022 (waiver FRA-2016-0110 – approved in 2017). Four approved waivers are due for extensions in year 3 of the analysis, *i.e.*, year 2024 (waivers FRA-2018-0026, 2018-0086, 2019-0008, 2019-0047 – all approved in 2019). Finally, 1 approved waiver is due for an extension in year 4 of the analysis, *i.e.*, year 2025 (waiver FRA-2020-0046 – approved in 2020). In sum, FRA expects 6 waiver extensions. Four of the 10 approved waivers may request waiver renewals during the period of analysis but are unlikely to do so based on the above conditions.

Thus, FRA expects THEERP operations to file 30 new waivers, 15 extensions of these new waivers, and 6 extensions of existing waivers. FRA estimated each new THEERP waiver petition requires 40 hours of labor, and each extension requires 8 hours of labor. Accounting for these labor hours at the STB Executives, Officials, & Staff

Assistants burdened wage rate yields a new waiver cost of \$3,097.50 per waiver, and a corresponding cost of \$4,646 for 1.5 new waivers per year.<sup>47</sup> The cost for a waiver extension is \$619.50 per extension. The costs are scheduled according to the frequency of occurrence of new THEERP waivers (1.5 per year), new THEERP waiver extensions (1 per year starting in year 6 of the analysis), and currently-approved THEERP waiver extensions (1 in year 1 of the analysis, 4 in year 4, and 1 in year 5). The cost schedule also accounts for extensions and renewals of the performance-based waiver at \$1,587 per extension or renewal (see below, 1 extension expected in year 2 of the analysis, and thereafter 1 renewal per each year in years 7, 12, and 17). As an example, in year 2 of the analysis, FRA expects 1.5 new THEERP waivers (\$4,646), and 1 alternative waiver extension (\$1,587), for a total estimated cost of \$6,234.

For regulated entities petitioning to use alternative methods to evaluate sheeting, FRA is not aware of any new methods in development and expects no new waiver filings. If a new performance-based waiver was filed, the cost to file such a waiver would be qualitatively high because it would likely involve extensive development and in-service testing like the comparator panel. Given the research to develop the comparator panel, FRA expects AAR will continue to file for extensions and renewals to extend the waiver's relief. Over the period of analysis, FRA estimated 4 extensions and renewals, requiring 20.5 hours each at the same Executives, Officials, & Staff Assistants wage rate for a per-waiver cost of \$1,587.47. FRA estimated the performance-based waiver extension requires more labor time than the THEERP-operations waiver extension because Class I railroads' operations are more complex. (A THEERP-operations waiver renewal, however, may involve detailed descriptions of the subject equipment that may add to the time to file a potential renewal.)

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<sup>47</sup> Calculation: Cost for 1 waiver = 40 hrs. x \$77.44 = \$3,097.50. Then 1.5 new waivers x \$3,097.50 per waiver = \$4,646.

Furthermore, the Federal Government expends resources to review these waiver petitions. Depending on the waiver, FRA's review will involve legal personnel, subject matter experts, administrative personnel, and railroad inspectors. FRA estimated these costs using the same respective labor hours as for THEERP-operations waivers and performance-based waivers above. For the wage rate, instead of using an average wage rate for the variety of personnel involved, FRA used a representative wage rate for GS-14 step 5 employees of \$115.29 per hour. The resulting FRA costs are \$4,611.60 for a new THEERP-operations waiver, \$922.32 for a THEERP-operations waiver extension, and \$2,363.45 for the comparator-panel waiver extension and renewal.

The following table presents the estimated baseline scenario cost elements. The Government costs are not included in the total baseline cost.

**Table V-2: Baseline Scenario Costs (2020 Dollars)**

<b>Baseline Cost Impact</b>	<b>Undiscounted</b>	<b>Present Value 7%</b>	<b>Present Value 3%</b>	<b>Annualized 7%</b>	<b>Annualized 3%</b>
Visual Inspection & Replacement (\$224.109)	\$168,460,499	\$89,233,646	\$125,313,342	\$8,423,025	\$8,423,025
10-Year Renewal (\$224.111)	\$211,175,170	\$111,859,638	\$157,087,664	\$10,558,758	\$10,558,758
Transportation for Non-SCABT Cars	\$161,000,000	\$85,281,815	\$119,763,673	\$8,050,000	\$8,050,000
Waivers	\$112,284	\$59,902	\$83,784	\$5,654	\$5,632
<b>Total Baseline</b>	<b>\$540,747,953</b>	<b>\$286,435,001</b>	<b>\$402,248,463</b>	<b>\$27,037,438</b>	<b>27,037,415</b>
Government Costs for Waivers	\$167,171	\$89,183	\$124,739	\$8,418	\$8,418

*c. NPRM Costs*

The first substantive change under the NPRM would add freight rolling stock used for THEERP operations to the list of excepted equipment under § 224.3. These operations would no longer need to file waivers and waiver extensions with FRA and thus save the associated paperwork costs. The benefits would equal the baseline costs for

waivers (when taken together with the similar type of benefits from codifying the comparator panel waiver).

The largest change under the NPRM would be evaluating rail cars with a comparator panel instead of replacing sheeting under the 10-year renewal cycle. THEERP operations and other railroads to which the Reflectorization Standards apply will incur costs for the following requirements:

- Cost for inspection and replacement of missing, damaged, or obscured retroreflective sheeting under § 224.109. This requirement is unchanged from the baseline except for removing old implementation dates.
- Cost to evaluate and replace sheeting under § 224.111. The NPRM retains the option to use the 10-year replacement cycle.
- Incidental cost for transporting rail cars that would not typically appear on a repair track or shop for a SCABT to renew sheeting under § 224.111. This cost occurs under the baseline too but is adjusted for relief from the 10-year replacement cycle, and longer expected sheeting life.
- Small entities that may use the 10-year replacement cycle option under § 224.111 (estimated at 15 percent of small entities).
- Cost of the comparator panel.
- Cost to recalibrate the comparator panel under § 224.111.
- Employee training to use the comparator panel as described in AAR Field Manual Rule 66. (The comparator panel inspection of reflective sheeting will become part of the SCABT and annual locomotive inspection.)

These cost elements may be represented by the equation:  $NPRM\ Cost = Visual$

$inspection\ \&\ sheeting\ replacement + Periodic\ evaluation\ \&\ sheeting\ replacement +$   
 $Transport + 10\text{-}year\ renewal\ option\ estimated\ for\ small\ entities + Comparator\ panel +$   
 $Comparator\ panel\ recalibration + Employee\ training.$

The cost for visual inspection and replacement of missing, damaged, or obscured sheeting remained the same as under the baseline scenario because FRA is only removing the references to the outdated implementation schedule. The substantive requirements remain the same.

The primary change under the NPRM would be evaluating the sheeting on rail cars with a comparator panel. The cost of using the comparator panels is determined by the number of cars undergoing a SCABT and evaluated with the comparator panel multiplied by the material and labor costs per car. Based on data supplied by AAR, FRA

estimated 571,750 cars will be evaluated, a preliminary inspection will require 2.8 minutes, cleaning will take 3.3 minutes, and the time to apply 1 sheet will require 9.3 minutes. AAR also found an average of 0.72 sheets renewed during their waiver at a cost of \$1.31 per sheet. FRA applied the STB Group 400 Maintenance of Equipment and Stores employee wage rate to estimate a cost per car of \$16.21, and \$9,270,752 per year for the affected cars. (In contrast, the estimated cost per car for sheeting renewal under the baseline scenario was \$68.21 per car.)<sup>48</sup>

The NPRM also allows use of a handheld retroreflectometer to directly evaluate the performance of sheeting. The retroreflectometer may be easier to use than the comparator panel, but given its current high cost (\$10,000), its use will likely be minimal at this time.

As in the baseline scenario, some rail cars may incur a transportation cost to renew sheeting because they may not periodically undergo a SCABT at a repair shop or track, or receive service from a mobile service agent. However, given the experience under the AAR comparator panel waiver showing reflective sheeting can likely remain effective beyond 10 years, these cars would need to be transported less frequently. These cars would no longer be subject to the 10-year renewal cycle. FRA used the estimates from Preston (2014) of an average reflector service life of about 20 years to calculate the reduced impact of cars needing transport for reflective sheeting replacement under the NPRM. Using a 20-year service life reduced the probability that cars would need transport by half to 5 percent, and the resulting expected cost per car from \$350 to \$175. Given the same number of cars needing transport as under the baseline scenario (23,000 cars), yielded a transportation cost of \$4,025,000 per year.

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<sup>48</sup> Calculation: Material cost per car = 0.72 sheets x \$1.31 per sheet = \$0.95. Labor cost per car = (2.8 min. inspection + 3.3 min. cleaning + 9.3 min. first sheet application) x \$1 per min. = \$15.27. Material and labor costs per car = \$0.95 + \$15.27 = \$16.21. Cost for evaluated cars = 571,750 cars x \$16.21 per car = \$9,270,750.

The NPRM contains an option for railroad car owners to continue using a 10-year replacement cycle for sheeting. FRA assumes that a portion of small entities will be most likely to choose this option to reduce their investment in the comparator panel and associated costs to implement it (such as training employees). Based on feedback from the American Short Line and Regional Railroad Association (ASLRRA), FRA understands most short line railroads are in fact using the comparator panel. However, for operations that find using the comparator panel costly, FRA estimated 15 percent of small entities will use the 10-year replacement option. To count the number of rail cars owned by small entities, FRA subtracted Class I railroad owned cars in North America, Class II railroad owned cars, and privately-owned cars from all freight cars—to estimate Class III railroads own 54,766 rail cars on average (over the years 2016 to 2020). Thus, 15 percent of these Class III railroad cars is 8,215 cars. FRA used AAR *Railroad Facts* books and Progressive Railroading magazine “Fleet Stats” for various years to determine car ownership.<sup>49</sup> Using the same percent of cars that would need full renewal under the baseline scenario of 10 percent means about 821 cars per year would need sheeting renewal. FRA applied the same cost per car for 10-year sheeting replacement as under the baseline scenario (\$68.21 per car) and estimated a cost of \$56,033 per year under the NPRM.

To estimate the number of comparator panels that may be purchased, FRA used the difference between the average number of shops and locations qualified to perform a SCABT and evaluate sheeting using a comparator panel, before and after the comparator panel waiver. AAR estimated an average of 1,570 shops and locations qualified for SCABTs before the waiver, and 1,063 shops and locations equipped with a comparator

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<sup>49</sup> AAR, *Railroad Facts* (Washington: multiple editions 2017–2020) 65-80. Foran, Pat, & Stagl, Jeff, eds., “Fleet Stats,” *Progressive Railroading* (multiple editions 2016–2019, and 2021). Year 2020 not available, 2019 Railroad Car Owners data carried over to 2020. Available: <https://www.progressiverailroading.com/keywords/keywords.aspx?id=0&keywords=Fleet+Stats&year=2017>. (May require log-in for some years.)

panel after the waiver; the difference of about 500 shops and locations represents the shops and locations that may purchase a comparator panel. AAR notes its estimates include shops and locations that performed five or more SCABT tests, so the actual counts may be higher. In addition, FRA internally estimated 300 shops and locations may need to purchase a comparator panel. FRA used an average of the two estimates for analysis, or 400 shops and locations. FRA assumed 1 comparator panel purchased per shop or location, and applied the \$190 cost per panel to estimate a marginal cost of \$76,000 for acquiring comparator panels. Furthermore, AAR offers these comparator panels may need replacement every 4 years (years 1, 5, 9, 13, and 17 of the 20-year period of analysis).

These comparator panels are also required to be periodically recalibrated (not later than 2 years) so that an accurate number of retroreflective sheets are replaced on rail cars. Given the 4-year average life of a comparator panel, a comparator panel will be typically recalibrated 1 time during its useful life. For example, if a comparator panel is purchased in year 1 of the period of analysis, it would be recalibrated in year 3, and a new comparator panel purchased in year 5. Over the period of analysis, recalibration would occur in in years 3, 7, 11, 15, and 19. Additionally, AAR estimated a recalibration cost of \$80 per panel with a discount if multiple panels are recalibrated per shop. As FRA does not know how many shops own multiple comparator panels, the cost of recalibrating one panel was used to estimate a cost of \$32,000 for recalibrating 400 comparator panels.

Employees inspecting and replacing reflective material likely would need training and instruction in these procedures. Rule 66, Reflective Sheeting, of the AAR Field Manual contains instructions for inspecting sheeting using the comparator panels. A manufacturer of comparator panels also provides step-by-step instructions on its website.<sup>50</sup> FRA assumed these comparator panel instructions will be combined with

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<sup>50</sup> Avery Dennison, available: [RR-Comparison-Panel-Kit\\_Overview.pdf](https://www.averydennison.com/RR-Comparison-Panel-Kit_Overview.pdf) (averydennison.com).



existing training sessions on performing SCABTs and locomotive inspections. FRA estimated a marginal training cost using the same amount of time estimated to inspect reflective sheeting using a comparator panel of 2.8 minutes, applied to 20,253 STB Group 400 Maintenance of Equipment and Stores employees at their wage rate, to calculate a training cost of \$55,739. Only the first year of training is considered because the cost of subsequent training is covered under the training rule, 49 CFR part 243.<sup>51</sup>

The following table presents the estimated NPRM cost elements.

**Table V-3: NPRM Costs (2020 Dollars)**

<b>NPRM Cost Impact</b>	<b>Undiscounted</b>	<b>Present Value 7%</b>	<b>Present Value 3%</b>	<b>Annualized 7%</b>	<b>Annualized 3%</b>
Visual Inspection & Replacement (\$224.109)	\$168,460,499	\$89,233,646	\$125,313,342	\$8,423,025	\$8,423,025
Periodic Evaluation & Sheeting Replacement (\$224.111)	\$185,415,041	\$98,214,480	\$137,925,381	\$9,270,752	\$9,270,752
Transportation for Non-SCABT Cars	\$80,500,000	\$42,640,907	\$59,881,836	\$4,025,000	\$4,025,000
10-Year Renewal Option est. for Small Entities	\$1,120,661	\$593,615	\$833,630	\$56,033	\$56,033
Comparator Panel	\$380,000	\$221,151	\$295,326	\$20,969	\$19,851
Comparator Panel Recalibration	\$160,000	\$81,699	\$117,210	\$7,712	\$7,878
Employee Training	\$55,739	\$52,092	\$54,115	\$4,917	\$3,637
<b>Total NPRM</b>	<b>\$436,091,940</b>	<b>\$231,038,590</b>	<b>\$324,420,840</b>	<b>\$21,808,408</b>	<b>\$21,806,176</b>

#### 4. *Alternatives*

FRA considered a few regulatory alternatives before deciding to offer stakeholders the option of using either the 10-year replacement cycle or the alternative

<sup>51</sup> Calculation: 2.8 min. marginal training time x \$1 per min. x 20,253 employees = \$55,739.

method (comparator panels) as proposed. As a presumably lower-cost alternative, FRA considered eliminating the 10-year replacement cycle completely given that most of the industry is using the comparator panel waiver. However, FRA assessed that some entities might incur higher costs for evaluating sheeting on MOW cars and other privately-owned cars using the comparator panel because these cars may not appear at a repair shop or on a repair track regularly for a SCABT. Some smaller entities with fewer cars may also find it easier to replace the retroreflective sheeting on their cars every 10 years. A pre-determined schedule for replacing sheeting provides regulatory simplicity for these entities and may be easier to implement than a comparator panel-based standard. Overall, including both alternatives as proposed increases regulatory flexibility for railroads and car owners.

FRA also considered stricter alternatives that would help FRA enforce the Reflectorization Standards. For example, FRA could mandate railroads and private-car owners record and report when retroreflective sheeting is changed. FRA could also require the industry to report which standard for evaluation and replacement they are following (*i.e.*, either the alternative replacement or the 10-year replacement cycle). As noted in the Overview section above, under the approved waiver for using the comparator panel, the industry has not been consistently recording in UMLER when and why sheeting is replaced. That makes it difficult to determine how much of the sheeting was replaced because of damage, and how much because of the passage of time. Given the size of the fleet and frequency of SCABTs, the record-keeping and reporting costs could be somewhat significant. Railroads would need to record and report information that is not currently required, including when the sheeting is replaced, why it is replaced (obscured, damaged, or missing), and how much of the rail car sheeting was replaced.

FRA estimates this would cost at least \$167,000 annually.<sup>52</sup> In return, better records could facilitate FRA enforcement, for example, to check if the overall rate of sheeting replacement under the NPRM is in-line with expectations for the service life of sheeting in various operations and environments. As proposed, enforcement will generally rely on FRA inspectors visually inspecting sheeting and SCABT data, which, given the low accident risk under the waivers historically, would provide a less costly alternative to requiring more record-keeping and reporting. For example, if an inspector observes sheeting to be in poor condition, and requests records from the railroad that list a recent SCABT, it would provide an indication the sheeting may not have been replaced when required.

#### 5. *Sensitivity Analysis*

The cost and benefit estimates could change if the analysis's underlying assumptions or inputs were to change. The largest categories of costs presented in Table V-3 are the pre-existing requirement to visually inspect and replace sheeting (§ 224.109), periodically evaluate and replace sheeting (§ 224.111), and transport cars that would not typically appear on a repair track or shop for a SCABT. The costs to visually inspect and replace sheeting, and to periodically evaluate and replace sheeting, depend primarily on the number of cars. The number of cars is about 750,000 and 500,000 respectively for these cost estimates. If the number of cars used in calculating these estimates were to increase, then the estimated net business benefits would increase too. The number of active freight cars may increase if economic growth continues in the short run, likely increasing the demand for freight transportation. FRA used an average of recent freight cars counts (2016-2020) as a reasonable estimate in its cost estimates.

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<sup>52</sup> The Paperwork Reduction Act (PRA) analysis for this proposal estimates a cost of \$167,000 for recording and reporting obscured, damaged, or missing sheeting under § 224.109. This analysis assumes the stricter alternative would require railroads to record and report additional data. As an approximation, the additional burden is another 5 minutes, or \$167,000 annually. Also, Railinc would incur a cost for programming changes to the UMLER database to accommodate the new data fields. FRA inspectors would also spend more time reviewing these more detailed records.

Furthermore, for the cost to periodically evaluate and replace sheeting, if the cost for purchasing a retroreflectometer decreases over time, or a cheaper substitute method of directly measuring the reflectivity becomes available, the labor time to evaluate the sheeting on a car will decrease. The benefits from using an alternative method will then increase as well.

For the transportation cost, the cost per car is a significant factor. FRA applied the probability of sheeting renewal to estimate this cost. As the actual service life of sheeting in different railroad operations and environments becomes better known, the need to transport cars to replace sheeting may further decrease, reducing this cost. Additionally, as mentioned, FRA used a proxy to estimate the number of cars that may need transportation, which is a source of uncertainty in the estimate, but conceptually represents the type of cars that may need transportation.

FRA also used STB wage rates in its estimates, based on the Class I railroads' reports to the STB. Using AAR wage rates will affect the scale of costs, but not the resources used in terms of capital (*i.e.*, the number of cars and comparator panels), and labor time used to comply with the regulation.

## *6. Conclusion*

As shown in Table V-1 above, FRA estimates the NPRM results in net benefits with a present value of \$55 million using a 7 percent discount rate and \$78 million using a 3 percent discount rate (over a 20-year period of analysis in 2020 dollars). In annualized terms, the net benefits are \$5 million per year using a 7 percent discount rate, and a similar \$5 million using a 3 percent discount rate. In addition, the Federal Government would save the cost of reviewing and analyzing waivers of about \$89,183 (present value, 7 percent discount rate); \$124,739 (present value, 3 percent discount rate), or \$8,418 (annualized, both 7 and 3 percent discount rates).

FRA also estimates there may be ancillary benefits of the NPRM in terms of reduced environmental impact from disposing of reflective sheeting prematurely. Given reflective sheeting can remain effective more than 10 years, there would be less reflective sheeting replaced under the NPRM during the period of analysis. Based on the Preston (2014) study, if reflective sheeting lasts 15 to 20 years, then there would be 50 percent to 100 percent less reflective sheeting replaced and disposed of in comparison to the mandatory 10-year replacement. The benefit would be less environmental waste. Although FRA has not quantified this benefit, it could be important given the large number of rail cars affected. As in the regulation before this NPRM, reflective sheeting would still need replacement earlier than 10 years if damaged or obscured. Also, in the long run, the reflective sheeting applied on all cars would need replacement and disposal eventually. FRA invites comment on these environmental benefits.

B. Regulatory Flexibility Act and Executive Order 13272

The Regulatory Flexibility Act of 1980 (5 U.S.C. 601 *et seq.*) and Executive Order 13272, “Proper Consideration of Small Entities in Agency Rulemaking,” (67 FR 53461 (Aug. 16, 2002)) require agency review of proposed and final rules to assess their impacts on small entities. An agency must prepare an Initial Regulatory Flexibility Analysis (IRFA) unless it certifies that a rule, if promulgated, would not have a significant economic impact on a substantial number of small entities. FRA has not determined whether this proposed rule would have a significant economic impact on a substantial number of small entities, and has therefore prepared this IRFA. FRA seeks comment from small entities on the economic impacts of this proposed rule.

1. *Reasons for Considering Agency Action*

FRA is initiating this rulemaking to codify two types of waivers that entities have submitted for relief from the Reflectorization Standards (or part 224). First, entities that operate rail freight rolling stock in THEERP operations have petitioned for exclusion

from the Reflectorization Standards. Generally, FRA has found these operations do not operate their equipment under low-light conditions (*i.e.*, at night) over highway-rail grade crossings. Therefore, these operations pose a low safety risk in terms of accidents/incidents preventable by retroreflective sheeting. By codifying waivers for equipment used in THEERP operations, FRA would provide relief from unnecessary paperwork burdens for these entities because they would no longer need to file these waivers. Second, the NPRM codifies a waiver granted to AAR to use an alternative method, specifically the comparator panel, to determine when to replace retroreflective sheeting. The existing Reflectorization Standards require replacement of retroreflective sheeting after 10 years of service, based on the best information available at the time the Reflectorization Standards were promulgated. Through its pilot program to test the comparator panel method, AAR has demonstrated that retroreflective sheeting can often perform effectively beyond 10 years. Using the comparator panel method allows retroreflective sheeting to be replaced as needed, resulting reduced costs and environmental waste. The comparator panel method may also result in replacing degraded or otherwise substandard sheeting sooner than it would have been under the 10-year replacement cycle, thus potentially increasing overall train visibility for motor vehicle drivers—and improving public safety. The proposed rule recognizes this more efficient method for evaluating retroreflective sheeting and makes it available to all entities operating freight rolling stock. In addition, the NPRM retains the option for entities to use the 10-year replacement cycle for entities that may find that method less burdensome for their particular operation. The proposed rule also removes outdated implementation schedules for retroreflective sheeting to improve regulatory clarity.

2. *A Succinct Statement of the Objectives of, and Legal Basis for, the Proposed Rule*

The objective of this proposed rule is to enhance safety, promote innovation, and reduce the unnecessary paperwork burdens on the railroad industry. The provision to

codify waivers for rail freight rolling stock used in THEERP operations would reduce paperwork costs for these operations. Except for larger railroads that operate older equipment as private business cars and for special events, most of the entities that operate rail cars used in THEERP operations are small entities. These small entities would benefit economically from the provision to codify THEERP-related waivers. The second provision to codify the alternative method (comparator panel) to determine when to replace retroreflective sheeting would reduce compliance costs for most of the railroad industry. ASLRRA indicated to FRA that most of the small railroads are using the comparator panel method; FRA estimates 85 percent of small entities are using the comparator panel, and 15 percent are using the 10-year replacement cycle. FRA has kept the 10-year replacement cycle as an alternative compliance method for that share of small entities that wish to use it. These small entities may have operations for which using the comparator panel may be burdensome, such as operating equipment that may not be regularly interchanged, and incurring the costs for purchasing and using the panel. Some small entities may also find it less burdensome and prefer the regulatory simplicity of following a predetermined replacement schedule for retroreflective sheeting. For entities using the 10-year replacement option, the cost to comply would remain the same as it is before the proposed rule. For the entities using the alternative replacement option, FRA estimates the costs to comply would decrease, while enhancing safety.

The Secretary of Transportation has broad statutory authority to “prescribe regulations and issue orders for every area of railroad safety” under 49 U.S.C. 20103, including reflectorization of rail freight rolling stock regulated in part 224. FRA’s review and codification of existing waivers issued under 49 U.S.C. 20103 is also responsive to section 22411 of the Infrastructure Investment and Jobs Act (Pub. L. 117-58).

3. *A Description of and, Where Feasible, an Estimate of the Number of Small Entities to Which the Proposed Rule Would Apply*

The Regulatory Flexibility Act of 1980 requires a review of proposed and final rules to assess their impact on small entities, unless the Secretary certifies that the rule would not have a significant economic impact on a substantial number of small entities. “Small entity” is defined in 5 U.S.C. 601 as a small business concern that is independently owned and operated and is not dominant in its field of operation. The U.S. Small Business Administration (SBA) has authority to regulate issues related to small businesses, and stipulates in its size standards that a “small entity” in the railroad industry includes a for-profit “line-haul railroad” that has fewer than 1,500 employees and a “short line railroad” with fewer than 500 employees.<sup>53</sup>

Federal agencies may adopt their own size standards for small entities in consultation with SBA and in conjunction with public comment. Under that authority, FRA has published a final statement of agency policy that formally establishes “small entities” or “small businesses” as railroads, contractors, and hazardous materials shippers that meet the revenue requirements of a Class III railroad as set forth in 49 CFR part 1201, General Instruction 1-1, which is \$20 million or less in inflation-adjusted annual revenues; and commuter railroads or small governmental jurisdictions that serve populations of 50,000 or less.<sup>54</sup> The \$20 million limit is based on the Surface Transportation Board’s revenue threshold for a Class III railroad carrier. Railroad revenue is adjusted for inflation by applying a revenue deflator formula in accordance with 49 CFR part 1201, General Instruction 1-1. The current threshold is \$40.4 million.<sup>55</sup> FRA is using this definition for the proposed rule.

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<sup>53</sup> “Size Eligibility Provisions and Standards,” 13 CFR part 121, subpart A.

<sup>54</sup> 68 FR 24891 (May 9, 2003) (codified at appendix C to 49 CFR part 209).

<sup>55</sup> The Class III railroad revenue threshold is \$40.4 million or less, for 2020. (The Class II railroad threshold is between \$40.4 million and \$900 million, and the Class I railroad threshold is \$900 million or more.) See Surface Transportation Board (STB), *Data Issued in Regulatory Proceedings*. Revenue Deflators. Available: <https://www.stb.gov/reports-data/economic-data/>. See also STB Decision, Docket No. EP 748, Indexing the Annual Operating Revenues of Railroads, Decided June 10, 2020. <https://prod.stb.gov/reports-data/economic-data/railroad-revenue-deflator-factors/>.



Based on railroads that report to FRA under part 225 (Railroad Accidents/Incidents), FRA estimates the universe of small railroads consists of 744 Class III railroads. The NPRM's provision codifying waivers related to rail cars used in THEERP operations affects primarily the tourist railroads. FRA estimates there are 123 tourist railroads that are Class III railroads to which the NPRM would apply. Although some of these tourist railroads may have been excepted before this rulemaking because they are not on the general railroad system of transportation, and are excepted under existing § 224.3, it may have been unclear to stakeholders which railroads were exempt. For the provision codifying the alternative method, FRA estimates 85 percent of the Class III universe that chooses to use the comparator panel to evaluate sheeting will be affected, or about 632 small railroads.

In addition, FRA knows of one manufacturer of comparator panels, specifically Avery Dennison Corp. Avery Dennison employs more than 750 persons, the SBA<sup>56</sup> benchmark for large businesses. There are other manufacturers of retroreflective sheeting; FRA is aware of ORAFOL Americas, Inc, a subsidiary of the ORAFOL Group, that has purchased Reflexite Corp., and the 3M Co. Both manufacturers currently do not make comparator panels and are large businesses.

4. *A Description of the Projected Reporting, Recordkeeping, and Other Compliance Requirements of the Rule, Including an Estimate of the Class of Small Entities That Will be Subject to the Requirements and the Type of Professional Skill Necessary for Preparation of the Report or Record*

The NPRM would provide relief for the small entities that operate rail freight rolling stock used in THEERP operations by excluding these rail cars from the Reflectorization Standards in part 224. In the absence of the NPRM, the affected

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<sup>56</sup> North American Industry Classification System (NAICS) Code 326113 signifies the Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing firms that would be affected by this proposal. Per SBA, any firm under NAICS code 326113 that employs more than 750 employees cannot qualify as a small business. U.S. Small Business Administration, *Table of Small Business Size Standards Matched to North American Industry Classification Codes* (Jan. 2019). Available: <https://www.sba.gov/document/support-table-size-standards>.

railroads would continue to submit waivers under part 224. As explained in the regulatory analysis above, FRA expects 30 new waiver submittals, 15 extensions of these waivers, and 6 extensions of existing THEERP associated waivers over the 20-year period of analysis. FRA estimated each new waiver costs \$3,097.50, each waiver extension costs \$619.50, and requires 40 hours of labor and 8 hours of labor respectively. FRA accounted for the labor time using the burdened STB wage rate for Professional and Administrative employees of \$77.44 per hour. In annualized terms using a 7 percent discount rate, the NPRM results in estimated paperwork reduction benefits of \$5,654 per year. When divided by the class of 123 tourist railroads, each tourist railroad would save \$45.79 per year.<sup>57</sup>

For the provision of the NPRM allowing use of an alternative method to evaluate and replace retroreflective sheeting, the compliance requirements for the small entities are the same as for all entities accounted for in the regulatory analysis above. This section generally uses annualized costs using a 7 percent discount rate to express the compliance costs for small entities. The annualized cost for the substantive change in the NPRM of using a comparator panel was estimated at \$5.59 per car, in comparison to a baseline 10-year replacement cost of \$6.37 per car, a savings of about \$1.00 per car.<sup>58</sup> The other significant cost factor of transporting cars that may not be regularly interchanged for replacing retroreflective sheeting was estimated at \$2.43 per car, or one-half the baseline cost. The cost for visual inspection and replacement under § 224.109, a requirement that does not change under the NPRM and so is “a wash,” is \$5.08 per car. The costs for purchasing and recalibrating the comparator panel are negligible when

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<sup>57</sup> Under the NPRM, railroads that operate equipment used in THEERP operations would save the cost of evaluating and applying retroreflective sheeting to their rail cars too, but since FRA has historically approved the majority of these waivers, the analysis accounts primarily for the savings from not having to file waivers.

<sup>58</sup> Calculation: NPRM cost =  $\$9,270,752 / 1,658,334$  avg. cars per year = \$5.59 per car. Baseline cost =  $\$10,558,758 / 1,658,334$  = \$6.37. Savings =  $\$6.37 - \$5.59 = \$0.78$  (annualized, 7%). The annualized costs were estimated using an undiscounted NPRM cost of \$16.21 per car and an undiscounted baseline cost of \$68.21 per car, for a difference of \$50.00 per car.

divided by the many cars in the fleet. The cost for the comparator panel is also mitigated by its widespread use; FRA estimates 85 percent of the small entities are using the comparator panel method. (In undiscounted terms, the cost of the comparator panel is \$190 per panel and \$80 for recalibration every 2 years.) For all railroads, training employees to use the comparator panel was estimated as a marginal addition to the training employees already receive for brake tests and locomotive inspections. FRA estimated the training time as the actual time to use the comparator panel, an addition of about 3 minutes per employee. For small entities, the cost to train employees may be higher if they cannot incorporate training to use the comparator panel as part of existing training.

In annualized terms at 7 percent, the estimated total compliance costs under the NPRM are \$13.15 per car, compared to baseline costs (*i.e.*, without the NPRM) of \$16.30 per car, a savings of \$3.15 per car. FRA estimated Class III railroads own 54,766 cars on average over the years 2016 through 2020. Thus, the estimated benefits for the small entities is \$172,760. When divided by the 632 railroads that would use the comparator panel method, each railroad would save \$273 per year (inclusive of waiver savings). These costs were estimated on a per-car basis. The benefits per small entity depends on the number of cars it operates.

5. *Identification, to the Extent Practicable, of All Relevant Federal Rules That May Duplicate, Overlap, or Conflict with the Proposed Rule*

FRA is not aware of any Federal rule that duplicates, overlaps with, or conflicts with the proposed rule.

6. *A Description of Significant Alternatives to the Rule*

For railroads that find using the comparator panel burdensome for their operations and equipment, the NPRM permits the continued use of the 10-year replacement cycle. FRA retained the 10-year replacement cycle as an alternative compliance method specifically to reduce the potential economic impact on small entities (and for other

entities that may have captive cars, *i.e.*, cars that are not regularly interchanged). The estimated 15 percent of small entities that continue to use the 10-year replacement cycle will see no change in their compliance costs from the regulation existing before the NPRM.

### C. Paperwork Reduction Act

FRA is submitting the information collection requirements in this proposed rule to the Office of Management and Budget (OMB) for approval under the Paperwork Reduction Act of 1995.<sup>59</sup> The sections that contain the new or revised information collection requirements and the estimated time to fulfill each requirement are as follows:

CFR Section	Respondent Universe	Total Annual Responses (A)	Average Time per Response (B)	Total Annual Burden (C = A * B)	Total Cost Equivalent in U.S. Dollar (D = C * wage rates) <sup>60</sup>
224.7—Waivers (Revised requirement due to proposed revision under § 224.3)	722 railroads and freight car owners	1 petition	8 hours	8 hours	\$619.52
224.15(b)—Special approval procedures—Petitions for special approval of alternative standard	2 manufacturers	1 petition	40 hours	40 hours	\$3,097.60
—(d) Public comment on special approval procedures/petitions	Manufacturers, railroads, or general public	3 comments on special petition	1 hour	3 hours	\$232.32
—(d)(3) Hearing on the petition in accordance with the procedures provided in § 211.25	FRA does not believe that it will not need any additional information to consider any submitted petitions under the above requirement. Consequently, there is no burden associated with this provision.				
—(e) Disposition of petitions	Exempted from PRA under 5 CFR 1320.4(2).				
224.101—General requirements	The burden for this requirement is covered under § 224.15.				
224.103(d)—Characteristics retroreflective sheeting—Certification	There would be no burden involved for new cars. Additionally, the cost for stamping, etching, molding, printing is included as part of the manufacturing process and consequently there is no burden associated.				
224.103(e)—Characteristics retroreflective sheeting—Alternative standards	The burden for this requirement is covered under § 224.15.				

<sup>59</sup> 44 U.S.C. 3501 *et seq.*

<sup>60</sup> Throughout the tables in this document, the dollar equivalent cost is derived from the 2020 Surface Transportation Board's Full Year Wage A&B data series using the appropriate employee group hourly wage rate that includes 75-percent overhead charges.

224.109(a)—Inspection and replacement of missing, damaged, or obscured retroreflective sheeting—Railroad freight cars—Railroads notification to person responsible for reporting mark after visual inspection for presence and condition when freight car on either side has less than 80% reflective sheeting of the damaged, obscured, or missing sheeting (revised text, section heading)	AAR/400 car shops	33,510.22 notifications of defect and restriction	5 minutes	2,792.52 hours	\$167,244.02
—(b) Locomotive record of freight retroreflective sheeting defects found after inspection kept in locomotive cab or in railroad accessible electronic database that FRA can access upon request.	722 railroads and freight car owners	2,459.70 records of defect and restriction	5 minutes	204.98 hours	\$12,276.25
224.111(c)—Evaluation and replacement of 10-year old or underperforming retroreflective sheeting—Performance-based replacement	The burden for this requirement is covered under 49 CFR 232.305 (2130-0008), or a locomotive receives an annual inspection required by 49 CFR 229.27 (OMB Control Number 2130-0004).				
224.111(c)(1)(iv)—Evaluation and replacement—Labeling	The cost of labeling is included as part of the manufacturing process and consequently there is no burden associated.				
Total <sup>61</sup>	722 railroads and 400 car shops	35,975 responses	N/A	3,049 hours	\$183,470

All estimates include the time for reviewing instructions; searching existing data sources; gathering or maintaining the needed data; and reviewing the information.

Pursuant to 44 U.S.C. 3506(c)(2)(B), FRA solicits comments concerning: Whether these information collection requirements are necessary for the proper performance of the functions of FRA, including whether the information has practical utility; the accuracy of FRA's estimates of the burden of the information collection requirements; the quality, utility, and clarity of the information to be collected; and whether the burden of collection

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<sup>61</sup> Totals may not add due to rounding.

of information on those who are to respond, including through the use of automated collection techniques or other forms of information technology, may be minimized. For information or a copy of the paperwork package submitted to OMB, contact Ms. Hodan Wells, Information Collection Clearance Officer, at 202-493-0440. Organizations and individuals desiring to submit comments on the collection of information requirements should direct them via email to Ms. Wells at [Hodan.Wells@dot.gov](mailto:Hodan.Wells@dot.gov).

OMB is required to decide concerning the collection of information requirements contained in this rulemaking between 30 and 60 days after publication of this document in the *Federal Register*. Therefore, a comment to OMB is best assured of having its full effect if OMB receives it within 30 days of publication. FRA is not authorized to impose a penalty on persons for violating information collection requirements that do not display a current OMB control number, if required. FRA intends to obtain current OMB control numbers for any new information collection requirements resulting from this rulemaking action prior to the effective date of the final rule. The OMB control number, when assigned, will be announced by separate notice in the **Federal Register**.

#### D. Federalism Implications

Executive Order 13132, Federalism,<sup>62</sup> requires FRA to develop an accountable process to ensure “meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications.” “Policies that have federalism implications” are defined in the Executive order to include regulations that have “substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.” Under Executive Order 13132, the agency may not issue a regulation with federalism implications that imposes substantial direct compliance costs and that is not required by statute, unless the Federal Government provides the funds

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<sup>62</sup> 64 FR 43255 (Aug. 10, 1999).

necessary to pay the direct compliance costs incurred by State and local governments or the agency consults with State and local government officials early in the process of developing the regulation. Where a regulation has federalism implications and preempts State law, the agency seeks to consult with State and local officials in the process of developing the regulation.

FRA has analyzed this proposed rule in accordance with the principles and criteria contained in Executive Order 13132. FRA has determined that this proposed rule has no federalism implications, other than the possible preemption of State laws under 49 U.S.C. 20106. Therefore, the consultation and funding requirements of Executive Order 13132 do not apply, and preparation of a federalism summary impact statement for the proposed rule is not required.

#### E. International Trade Impact Assessment

The Trade Agreements Act of 1979 prohibits Federal agencies from engaging in any standards or related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. This proposed rule is not expected to affect trade opportunities for U.S. firms doing business overseas or for foreign firms doing business in the United States.

#### F. Environmental Impact

FRA has evaluated this proposed rule consistent with the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*), the Council of Environmental Quality's NEPA implementing regulations at 40 CFR parts 1500–1508, and FRA's NEPA implementing regulations at 23 CFR part 771 and determined that it is categorically excluded from environmental review and therefore does not require the preparation of an environmental assessment (EA) or environmental impact statement (EIS). Categorical

exclusions (CEs) are actions identified in an agency's NEPA implementing regulations that do not normally have a significant impact on the environment and therefore do not require either an EA or EIS.<sup>63</sup> Specifically, FRA has determined that this proposed rule is categorically excluded from detailed environmental review pursuant to 23 CFR 771.116(c)(15), "[p]romulgation of rules, the issuance of policy statements, the waiver or modification of existing regulatory requirements, or discretionary approvals that do not result in significantly increased emissions of air or water pollutants or noise."

The main purpose of this rulemaking is to revise FRA's Reflectorization Standards to reduce unnecessary costs and provide regulatory flexibility while maintaining safety. This rulemaking would not directly or indirectly impact any environmental resources and would not result in significantly increased emissions of air or water pollutants or noise. In analyzing the applicability of a CE, FRA must also consider whether unusual circumstances are present that would warrant a more detailed environmental review.<sup>64</sup> FRA has concluded that no such unusual circumstances exist with respect to this proposed rule and it meets the requirements for categorical exclusion under 23 CFR 771.116(c)(15).

Pursuant to Section 106 of the National Historic Preservation Act and its implementing regulations, FRA has determined this undertaking has no potential to affect historic properties.<sup>65</sup> FRA has also determined that this rulemaking does not approve a project resulting in a use of a resource protected by Section 4(f).<sup>66</sup>

G. Executive Order 12898 (Environmental Justice)

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" require DOT agencies to achieve

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<sup>63</sup> 40 CFR 1508.4.

<sup>64</sup> 23 CFR 771.116(b).

<sup>65</sup> See 16 U.S.C. 470.

<sup>66</sup> See Department of Transportation Act of 1966, as amended (Pub. L. 89-670, 80 Stat. 931); 49 U.S.C. 303.



environmental justice as part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects, including interrelated social and economic effects, of their programs, policies, and activities on minority populations and low-income populations. The DOT order instructs DOT agencies to address compliance with Executive Order 12898 and requirements within the DOT order in rulemaking activities, as appropriate, and also requires consideration of the benefits of transportation programs, policies, and other activities where minority populations and low-income populations benefit, at a minimum, to the same level as the general population as a whole when determining impacts on minority and low-income populations. FRA has evaluated this proposed rule under Executive Order 12898 and the DOT order and has determined it would not cause disproportionately high and adverse human health and environmental effects on minority populations or low-income populations.

#### H. Unfunded Mandates Reform Act of 1995

Under section 201 of the Unfunded Mandates Reform Act of 1995,<sup>67</sup> each Federal agency “shall, unless otherwise prohibited by law, assess the effects of Federal regulatory actions on State, local, and tribal governments, and the private sector (other than to the extent that such regulations incorporate requirements specifically set forth in law).” Section 202 of the Act (2 U.S.C. 1532) further requires that “before promulgating any general notice of proposed rulemaking that is likely to result in promulgation of any rule that includes any Federal mandate that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of \$100,000,000 or more (adjusted annually for inflation) in any 1 year, and before promulgating any final rule for which a general notice of proposed rulemaking was published, the agency shall prepare a written statement” detailing the effect on State, local, and tribal governments and the

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<sup>67</sup> Pub. L. 104-4, 2 U.S.C. 1531.

private sector. This proposed rule would not result in the expenditure, in the aggregate, of \$100,000,000 or more (as adjusted annually for inflation) in any one year, and thus preparation of such a statement is not required.

#### I. Energy Impact

Executive Order 13211, “Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use,” requires Federal agencies to prepare a Statement of Energy Effects for any “significant energy action.”<sup>68</sup> FRA evaluated this proposed rule under Executive Order 13211 and determined that this regulatory action is not a “significant energy action” within the meaning of Executive Order 13211.

#### J. Privacy Act Statement

In accordance with 5 U.S.C. 553(c), DOT solicits comments from the public to better inform its rulemaking process. DOT posts these comments, without edit, to [www.regulations.gov](http://www.regulations.gov), as described in the system of records notice, DOT/ALL-14 FDMS, accessible through [www.dot.gov/privacy](http://www.dot.gov/privacy). To facilitate comment tracking and response, we encourage commenters to provide their name, or the name of their organization; however, submission of names is completely optional. Whether or not commenters identify themselves, all timely comments will be fully considered. If you wish to provide comments containing proprietary or confidential information, please contact the agency for alternate submission instructions.

#### **List of Subjects in 49 CFR Part 224**

Penalties, Railroad safety, Reflectorization standards.

#### **The Proposed Rule**

For the reasons stated above, FRA proposes to amend part 224 of chapter II, subtitle B of title 49, Code of Federal Regulations, as follows:

#### **PART 224—REFLECTORIZATION OF RAIL FREIGHT ROLLING STOCK**

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<sup>68</sup> 66 FR 28355 (May 22, 2001).

1. The authority citation for part 224 continues to read as follows:

Authority: 49 U.S.C. 20103, 20107, 20148 and 21301; 28 U.S.C. 2461 note; and 49 CFR 1.89.

2. Amend § 224.3 by revising paragraphs (c) and (d) and adding paragraph (e) to read as follows:

**§ 224.3 Applicability.**

\* \* \* \* \*

(c) Locomotives and passenger cars used exclusively in passenger service;

(d) Freight rolling stock that is subject to a reflectorization requirement promulgated by another Federal agency; or

(e) Freight rolling stock used for only for tourist, historic, excursion, educational, recreational, or private purposes, except for incidental freight service.

**§ 224.107 [Removed and Reserved]**

3. Remove and reserve § 224.107.

4. Revise § 224.109 to read as follows:

**§ 224.109 Inspection and replacement of missing, damaged, or obscured retroreflective sheeting.**

(a) *Railroad freight cars.* Retroreflective sheeting on railroad freight cars subject to this part must be visually inspected for presence and condition whenever a car undergoes a single car air brake test required under 49 CFR 232.305. If at the time of inspection less than 80 percent of the amount of sheeting required under § 224.105 on either side of a car is present, not damaged, and not obscured, the inspecting railroad or contractor shall promptly notify the person responsible for the reporting mark, as indicated in the Universal Machine Language Equipment Register, of the damaged, obscured, or missing sheeting (unless the inspecting railroad or contractor is the person responsible for the reporting mark). The inspecting railroad or contractor shall retain a

written or electronic copy of each such notification made for at least two years from the date of the notice and shall make these records available for inspection and copying by the FRA upon request. Any person notified of a defect under this section shall have nine months (270 calendar days) from the date of notification to repair or replace the damaged, obscured, or missing sheeting. Where the inspecting railroad or contractor is the person responsible for the reporting mark, the person shall have nine months (270 calendar days) from the date of the inspection to repair or replace the damaged, obscured, or missing sheeting.

(b) *Locomotives*. Retroreflective sheeting must be visually inspected for presence and condition when the locomotive receives the annual inspection required under 49 CFR 229.27. If at the time of inspection, less than 80 percent of the amount of sheeting required under §224.105 on either side of a locomotive is present, not damaged, and not obscured, the damaged, obscured, or missing sheeting must be repaired or replaced within nine months (270 calendar days) from the date of inspection, provided a record of the defect is maintained in the locomotive cab or in a secure and accessible electronic database to which FRA is provided access on request.

5. Revise § 224.111 to read as follows:

**§ 224.111 Evaluation and replacement of 10-year old or underperforming retroreflective sheeting.**

(a) *Replacement process*. Retroreflective sheeting required by this part shall comply with the replacement process in either paragraph (b) or (c) of this section.

(b) *10-year replacement cycle*. Regardless of condition, retroreflective sheeting required by this part shall be replaced with new, undegraded, sheeting no later than 10 years after the initial installation date. At the time of replacement, it is not necessary to remove the previously installed sheeting unless it interferes with the placement of the replacement sheeting, as required by § 224.106, but the previously installed sheeting shall

not be considered in calculating the required minimum area of retroreflective material required as shown in Table 2 to this subpart.

(c) *Replacement based on retroreflective comparator panel.* Except as provided in paragraph (c)(3) of this section, retroreflective sheeting shall be evaluated using a properly calibrated comparator panel, manufactured to the specifications outlined under paragraph (c)(1) of this section, whenever a car undergoes a single car air brake test required by 49 CFR 232.305, or a locomotive receives an annual inspection required by 49 CFR 229.27.

(1) *Retroreflective comparator panel specifications—(i) Retroreflectivity.* Retroreflective comparator panels shall have the minimum (and maximum, if applicable) retroreflectivity values as outlined in Table 1 to paragraph (c)(1)(iv) of this section.

(ii) *Color.* Retroreflective comparator panels shall be yellow or white as outlined in § 224.103(b).

(iii) *Construction.* Retroreflective comparator panels shall be 4 inches wide by 4 inches high, be constructed with glass-beaded material or other material that displays uniform appearance when rotated and viewed with a light source, and have a magnetic backing so that the panel can be attached to rail freight rolling stock.

(iv) *Labeling.* Retroreflective comparator panels shall have a waterproof and dust-proof label affixed to the backing. The label shall contain: the phrase “Retroreflective Comparator Panel – Yellow” or “Retroreflective Comparator Panel – White;” and the name of the manufacturer, the part, model, or serial number, the date the panel was manufactured, the target retroreflectivity level to which the panel was manufactured (measured in  $\text{cd/lx/m}^2$ ), and a space provided for the certified recalibration date. Retroreflective comparator panels shall be recalibrated at least every two years and the date of a panel’s most recent recalibration must appear in the space provided on the label.

**Table 1 to § 224.111(c)(1)(iv) – Retroreflective Comparator Panel Requirements**

<b>Retroreflective Comparator Panel Requirements</b>			
<b>Color</b>	<b>Required Retroreflectivity (cd/lx/m<sup>2</sup>) at -4° entrance and of 0.2° observation angles</b>		<b>Required Retroreflectivity (cd/lx/m<sup>2</sup>) at 30° entrance and of 0.5° observation angles</b>
	<b>Minimum</b>	<b>Maximum</b>	<b>Minimum</b>
<b>White</b>	250	285	60
<b>Yellow</b>	150	170	35

(2) *Retroreflective comparator panel evaluation process and criteria.* Each retroreflective sheeting on rail freight rolling stock shall be evaluated on its performance through use of a properly calibrated comparator panel. The evaluation procedure shall consist of the following:

(i) Retroreflective sheeting shall be visually evaluated with the use of a light source. The light source must be of sufficient intensity to illuminate and overcome ambient lighting conditions. A brighter light source (LED) is recommended in daylight conditions.

(ii) Retroreflective comparator panels shall conform to the requirements outlined in paragraph (c)(1) of this section, and the panel's color shall match the color of the installed sheeting being evaluated.

(iii) The comparator panel shall be placed directly adjacent to, or overlapping, the retroreflective sheeting being evaluated. The retroreflective sheeting shall also be cleaned, as necessary, before the evaluation begins.

(iv) Retroreflective sheeting and the comparator panel shall be evaluated from a position perpendicular to the installed sheeting, preferably from a distance of 15 feet from the installed sheeting and the comparator panel. In the event conducting the evaluation from 15 feet away is not practicable, the evaluation may be conducted from a distance of between 10 and 20 feet.

(v) The light source shall be positioned adjacent to the inspector's eye (left or right) and directed at the sheeting and comparator panel, and a comparison of the reflected light intensity of the entire installed sheeting to that of the comparator panel shall be made. The installed sheeting shall pass or fail based on the following criteria:

(A) If the perceived reflected light intensity of the entire installed sheeting appears brighter than that of the comparator panel, the installed sheeting passes the evaluation.

(B) If the perceived reflected light intensity of the entire installed sheeting does not appear brighter than that of the comparator panel, or if it cannot be discerned if one is brighter than the other, the sheeting fails the evaluation and shall be replaced prior to the equipment returning to service.

(C) Installed sheeting that is damaged, obscured, or missing, cannot be evaluated with the comparator panel and shall be replaced prior to the equipment returning to service.

(3) *Handheld retroreflectometers.* A properly calibrated handheld retroreflectometer may be used in lieu of a comparator panel, subject to the following conditions:

(i) The handheld retroreflectometer shall be an annular device. A single measurement on a strip of sheeting shall suffice with an annular device, provided that the sheeting is not damaged, obscured, or missing.

(ii) The handheld device shall be placed directly against the reflective sheeting, and the measurement shall be made based on the device manufacturer's recommendation.

(iii) The minimum allowable retroreflective value is 150 cd/lx/m<sup>2</sup> for yellow sheeting and 250 cd/lx/m<sup>2</sup> for white sheeting, when measured at the -4° entrance angle and 0.2° observation angle configuration. Sheeting that does not meet these minimum

allowable retroreflectivity values shall be replaced prior to the equipment returning to service.

Issued in Washington, D.C.

**Amitabha Bose,**  
*Administrator.*

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